# SCIENTIFIC AMERICAN

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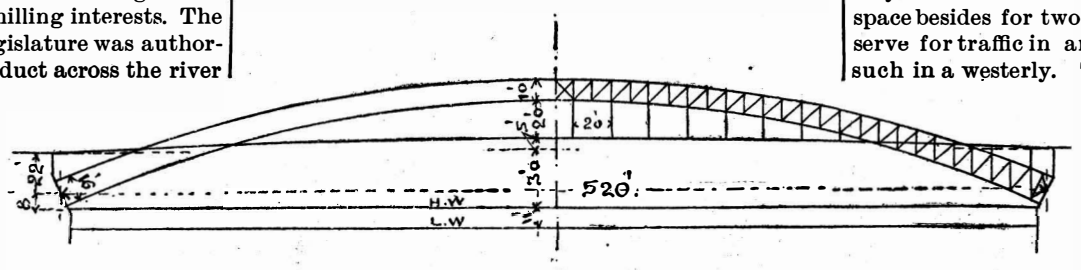
## HILGARD'S DESIGN FOR A STEEL ARCH BRIDGE AT MINNEAPOLIS.

The question as to which design of bridge shall be adopted to take the place of the present suspension bridge in Minneapolis is still pending between the city of Minneapolis and the Minneapolis Mill Co., a corporation which controls the greater part of the large water power of the Mississippi and the milling interests. The city proposed, and by act of the legislature was authorized, to construct a stone arch viaduct across the river above the Falls of St. Anthony, as the present suspension bridge has become insufficient to accommodate all the traffic on the principal thoroughfare between East Minneapolis and the business center of the city. The Minneapolis Mill Co., fearing detrimental effects which the sinking of the foundations and the presence of four stone piers in the river bed may have upon their interests, enjoined the city in time, and thus prevented her from proceeding in the construction of the bridge. Hereupon the city offered a compromise, proposing to substitute the stone arch viaduct by a steel arch bridge of two deck spans of 260 feet each, with but one pier in the middle of the river. The Minneapolis Mill Co., however, in order not to lose any right to claim damage in the event of the one pier being built, still maintained the granted injunction, requesting that a bridge be built without any pier whatever in the river bed, and it seems that the question will have to be decided by court.

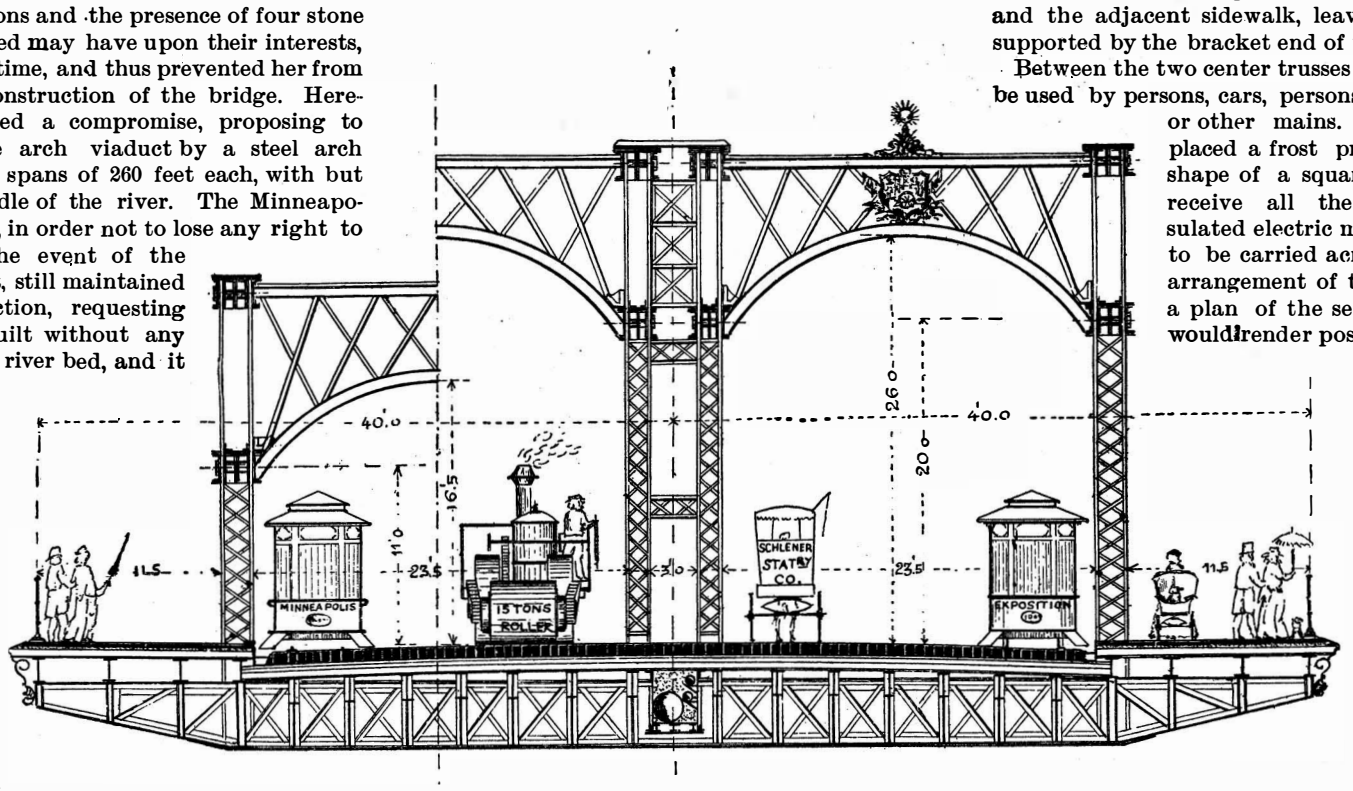
These circumstances gave origin to the design of the one span steel arch bridge as proposed by Mr. K. Emil Hilgard, a civil engineer, until lately, of the St. Paul & Northern Pacific Railway Co., of Minneapolis. The plan was submitted to the Minneapolis Mill Co., and has been favorably considered. The design is a splendid one, and we take pleasure in presenting it to our readers. The following particulars are from the Minneapolis *Tribune*.

The bridge across the river proper is 540 feet long, and intended to join and match the succession of short spans covering the Union Depot tracks at the west end. The intended width of the bridge is 80 feet from outside to outside, thus providing for two separate roadways in the center of the bridge, each 24 feet wide, and two separate sidewalks of 12 feet width in clear, each one at each outside of the bridge. Each roadway to have a street car track, and to leave ample space besides for two large teams. One roadway is to serve for traffic in an easterly direction, the other for such in a westerly. The whole floor surface, by means of posts, floor beams, and secondary longitudinal girders, is partly supported by, but to the greater extent is suspended from, a set of four braced steel arched trusses, two of which are coupled between the two roadways, and the others to be placed between each roadway and the adjacent sidewalk, leaving thus the latter supported by the bracket end of the floor beam.



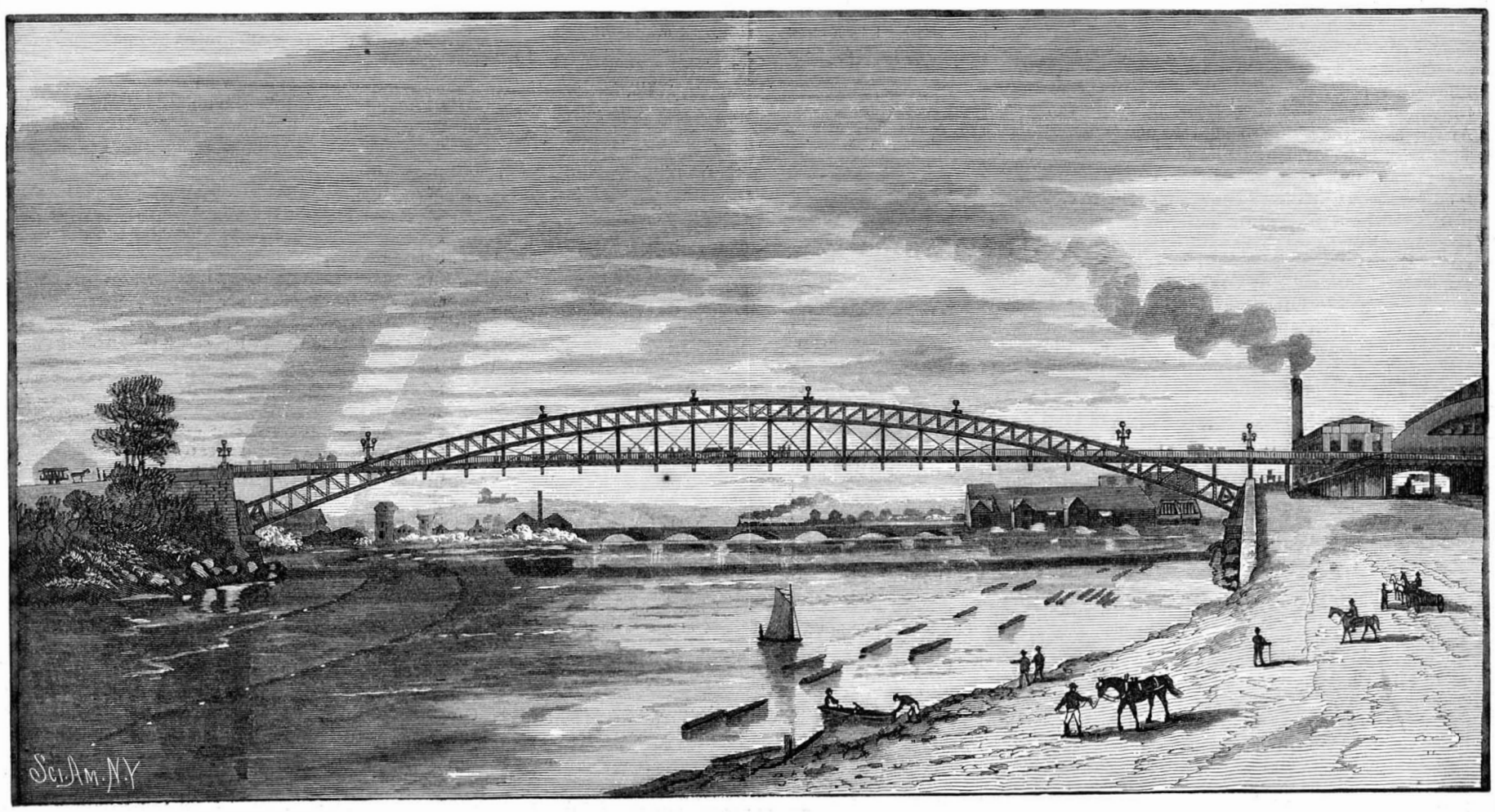

GENERAL DIMENSIONS.

Between the two center trusses is room for a walk to be used by persons, cars, persons in repairing the gas or other mains. Under this walk is placed a frost proof conduit, in the shape of a square box, which is to receive all the water, gas, and insulated electric mains which will have to be carried across the river. This arrangement of trusses, as shown in a plan of the section of the bridge, would render possible, should it prove desirable, the erection of one half of the full width of the bridge at first, alongside of the present suspension bridge, and of the other half after the removal of the latter, thus permitting the use of one sidewalk of 12 feet and one roadway of 24 feet in width while the suspension bridge is in use or being taken down.




SECTION SHOWING LOWEST HEADROOM. SECTION IN CENTER OF SPAN. SCALE—10 FEET EQUAL 1 INCH.

The bridge, as pro-



PROPOSED STEEL ARCH BRIDGE AT MINNEAPOLIS, MINN.—BY K. EMIL HILGARD, C.E.

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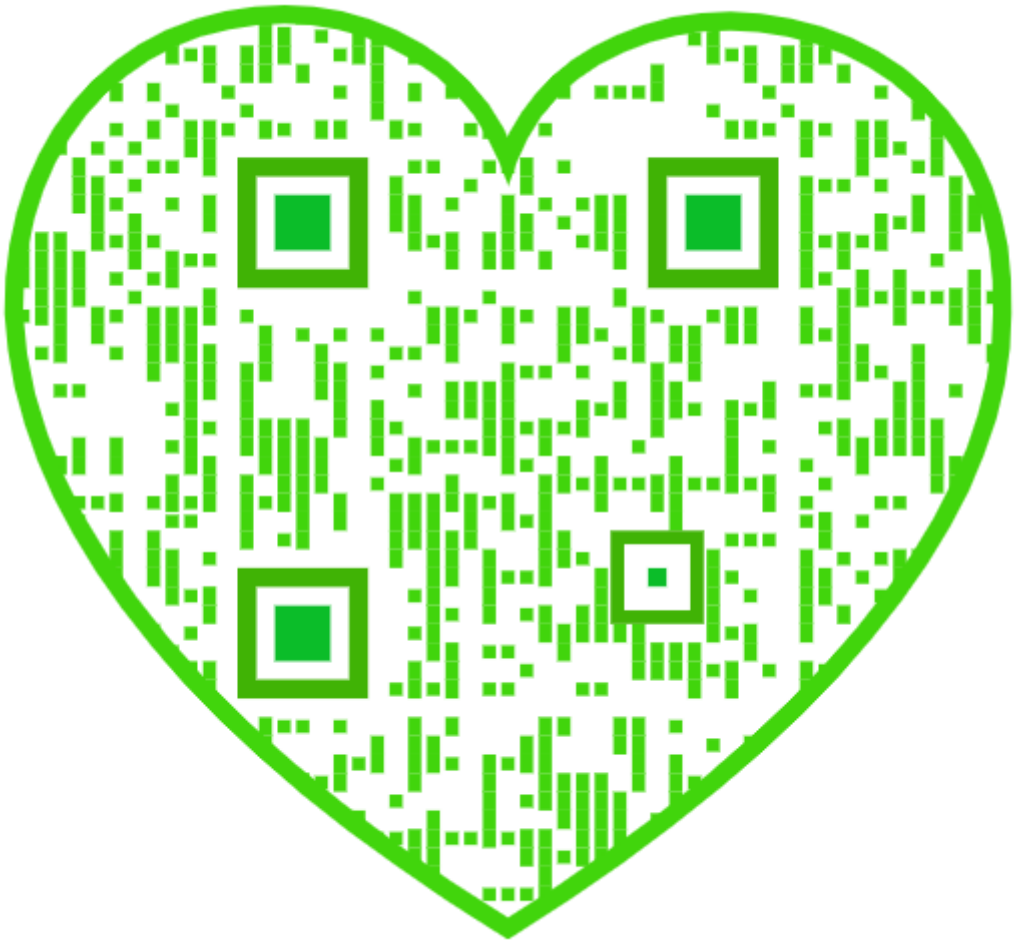

posed by Mr. Hilgard, is in the greater part of the type termed "through bridge," which means that the head room above the passing teams is not unlimited. The unobstructed, clear head room varies from 16 feet toward the ends of the bridge, where the arch rises above the roadway, to upward of 25 feet in the center of the span. The arch proper is of the pin-connected type, and has a span of 520 feet from end pin to end pin. The ratio of rise to span is as one to ten. This ratio might easily be changed into a more "economical" one, as 1 : 9 or 1 : 8, without much changing the appearance of the whole structure. The roadway, for the sake of appearance and drainage as well, is shown with a slight camber, amounting to five feet in the center. The steel arch proper is 16 feet high at the ends and 10 feet high in the center. As shown in plan of section, the construction of the floor surface provides for pine block pavement of usual type for teams, and granite between and next adjoining the street car tracks. For the sidewalks cement plates are proposed, the latter, as well as the stone blocks, to be solidly embedded in sand and gravel. A thorough drainage of the whole bridge surface and under the pine blocks in particular is also designed, such as to make the bridge floor first-class and durable in every respect. It is proposed to light the bridge by means of a few chandeliers carrying electric globes.

The advantages claimed for the design are the following:

It dispenses with all and every foundation to be put in the river bed proper (which might or might not involve a great many difficulties and expenses). A bridge of the kind Mr. Hilgard suggests will in no way interfere with the judiciously guarded interests of the Minneapolis water power, as it leaves the conditions of the river exactly as they are at present. It will make a solid and rigid structure, adapted to carrying the heaviest traffic that ever passed over a first-class city bridge. A bridge of any other system than the suspension or cantilever, and yet belonging to the type called deck bridge, while it would, if practical, have the advantage of an unlimited head room above the passing teams, is utterly impracticable, both from an engineering and from an æsthetic point of view, unless at least one pier is put in the river bed proper. A suspension bridge, as well as cantilever, ought to be avoided, from professional and financial reasons. The practically unavoidable necessity, incurred in the adoption of a through bridge, of having two separate roadways, has been emphasized; but this objection is at variance with what has been considered desirable, or even necessary, on the largest bridges in New York, St. Louis, etc., where the traffic in each direction is confined to a separate part of the bridge.

### New Method of Making Water Gas.

The Glasgow *Engineer* says that a new method of making water gas at an extremely low cost was the subject of a recent communication to the French Academy of Science, and that "the matter has caused much anxious attention, not only in France, but all over Europe and in England as well." It is of weighty importance, not only to gas but also to iron makers, if it accomplishes what is predicted of it. A jet of superheated steam is directed into a retort full of incandescent coke. The oxygen unites with carbon to form carbonic acid, and hydrogen is liberated. So far nothing new. The gases are led to a second retort filled with some refractory substance kept red hot, by which a glowing surface is exposed to the gases. At the same time, superheated steam is introduced. This seizes upon the carbonic oxide to form dioxide, and more hydrogen is liberated. A milk of lime bath removes the carbonic dioxide, and the pure hydrogen is led to a reservoir. One ton of coke in this process produces about 69,000 feet of gas, which is about eleven times the quantity usually produced by the expenditure of a ton of coal. This reduces the cost to little, if anything, more than that of natural gas, when the difficulty of controlling the latter is taken into the account. This is for heating purposes. Inventors are at work devising the best methods of carbureting it, and Boulogne-sur-Seine is to be lighted with it next winter.

### The Relative Value of Natural Gas and Coal.

Of Pittsburg coal 55·4 pounds contain the same number of heat units as 1,000 cubic feet of natural gas. With coal at $1.20 per ton, 1,000 feet of natural gas would then be worth 3⅓ cents. But by tests made by the Westinghouse Air Brake Company, 1·18 cubic feet of natural gas evaporated one pound of water from 190° Fah., with the same boiler under which one pound of the best coal evaporated 10·38 pounds of water. That is, one pound coal equals 12·25 cubic feet of gas, or 1,000 feet gas equal 81$\frac{32}{49}$ pounds coal. This difference results from the expenditure of heat necessary to raise solid fuel to the gaseous state, which must be done before combustion can take place. In a house grate the loss on this score from using coal would be more than in a large furnace of a factory. Hence, the greater economy in the use of natural gas is in houses and small establishments.


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### TWINE.

Few persons have an idea of the enormous consumption of twine in this country. One of the greatest demands for the article comes from the farmers, who consume thirty-five thousand tons annually upon the self-binding harvesters. Allowing five pounds to the mile, this would be equal to a string long enough to go more than six times round the earth. It takes a length of about three feet of twine to tie a bundle of straw. The farmer sits on his machine, drives alone through his grain field, and without any assistance cuts, bundles, and ties twelve acres of wheat grain per day. To such perfection as this has that unconscionable patent monopolist, the American inventor, reduced mechanism for doing farm labor—monopolist in the judgment of the farmer, because the inventor demands a bonus of perhaps ten dollars a machine as his patent fee. This winter, no doubt, our grateful farmer will, as usual, join the hue and cry for the repeal of the patent laws.

The twine used on the self-binder is generally made either of Sisal or Manila hemp. The Sisal is the cheaper material, but is not so strong or durable as the Manila. In some twines a mixture of the two is employed. For binder purposes, the twine should have sixteen turns to the foot, and a length of three feet would have a breaking strength of not less than seventy pounds. The twine must be carefully made, free from swells or knots, or it will not run smoothly through the knotting device of the binder. The average consumption of twine on a binder harvester is two pounds per acre. About twelve hundred feet of twine per acre are required. It costs the farmer about 25 cents an acre for his twine.

The Manila hemp makes much the better twine, being stronger, smoother, and more durable; the raw material costs more, and its twine sells for more than Sisal hemp, but the Manila twine goes further, and is actually cheaper in use for the farmer; but this fact however is not appreciated by him, and he sticks to the Sisal twine because offered a little less per pound than the better article of Manila. Then, again, the Sisal twine breaks much oftener while running through the binder than the Manila. At every break the farmer must stop his machine, and spend ten or twenty minntes to fix up. He never thinks of charging his lost time against his poor twine. As long as he gets it for a cent or two less than the better article he is perfectly satisfied, no matter if it does bother him.

### Woolen Manufactures in Japan.

Although it appears that there is no probability of wool being grown in Japan, as the only sheep in that country are animals reared with great trouble as curiosities, it is said that woolen manufactures will probably be carried on to advantage there. The Japanese of the upper classes are very generally adopting European clothing; and though this is now principally made by native tailors, all the cloth comes from abroad, especially from Vermont and other New England States. Woolen fabrics are being used very extensively among the rich, and before long the same articles bid fair to become popular with the poorer people. The Japanese government and nation see that there is a fair field for starting woolen manufactures in their country; and, taking into consideration the imitative faculties of this people, and the low rate of wages at which they are content to work, they are likely soon to become proficient in manufacturing too, if they can get the wool, especially as they have shown themselves to be capable of using machinery and other aids to labor which twenty years ago were unknown to them. If wool could be imported, a great industry might be established. The wool of New Zealand and Australia is said to be more suitable than that grown in America for manufacturing cloth for Japan, on account of its greater fineness; and as this latter country has so many products, such as tea, sugar, and rice, all of which are marketable commodities in Australasia, the commercial relations between Japan and those colonies, it is thought, might be developed advantageously by a mutual exchange of produce.

### Piston Area and Heating Surface.

However much change may be effected in the type of a locomotive, certain proportions appear to be incapable of alteration without doing harm; 2½ square feet of heating surface ought to be provided for each square inch of piston area, or, what comes to the same thing, the area of one piston multiplied by 5 will give the proper heating surface. Thus, the area of a 17 inch piston is 227 square inches, and 227×5=1,135 square feet. An 18 inch cylinder has an area of 254·4 inches, and 254·4×5=1,272. In like manner the proper surface for 19 inch cylinders is 1,417 square feet. Of course, this is not to be regarded as a hard and fast rule, but it will be found that it is quite in accord with the best locomotive practice of the day, and that when an attempt has been made to reduce the proportion, the engines have not proved good steamers with heavy trains.

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### PHOTOGRAPHIC NOTES.

*Enlarging for Newspapers.*—Since the introduction of cuts in daily newspapers has become so regular, different methods have been pursued to quickly reproduce by means of photography any important daily incidents.

Reporters frequently carry small cameras, such as the vest camera and others, with them, and often capture on the sensitive plate accurate views of the subjects they are interested in. The method now pursued in one of the largest offices is to employ a special photographer, who develops immediately the sensitive plate as soon as it arrives ; then in a wet state places it in a magic lantern, and projects the negative image downward upon a large sheet of paper placed on a table at which is seated an artist who quickly sketches over all the light portions with his pencil ; these portions fortunately are those which need to be reproduced in black lines. From the enlarged sketch, after it is inked and embellished, reduced electrotypes are produced by the usual process of photo-engraving rapidly.

*Directions for Stripping Films from Paper.*—A special combined film laid on paper, and styled the "American stripping film," has been prepared by the Eastman Dry Plate and Film Co., by means of which, with a little trouble, negatives equal to glass are readily produced, and at the same time the necessity for carrying around a lot of the latter material is avoided. It is specially advised that this particular paper be developed with the ferrous oxalate developer, since the toning qualities of the pyro developer (most generally preferred) are apt to interfere with the successful separation of the film from the paper.

The editor of the *Photographic News* having experimented in this direction, advises the use of the pyro and soda or potash developer.

### Electric Light Wire Legislation Needed.

Mr. I. N. Miller, of Cincinnati, writing to the *Electrician*, says : The electric light companies are stringing over housetops and on poles, throughout almost every city of 10,000 inhabitants in the United States, what is called "underwriters' approved wire." The name is supposed to be a first-class recommendation for the wire, and serves as a cloak to cover a multitude of evils. The board of underwriters probably approved the use of this wire throughout buildings, but they certainly never recommended or approved its use outdoors, where it would be subject to moisture.

Careful experiments made by immersing 12 inches of this wire in a 6×8 glass jar filled with water, the ends of the wire extending above the jar so that the water would come in contact with the covering only, shows the following insulating properties :

| | |
|---|---|
| After 1 minute's time | resistance, 115,000 ohms. |
| After 3 minutes' time | resistance, 4,170 ohms. |
| After 5 minutes' time | resistance, 1,770 ohms. |
| After 1 hour's time | resistance, 280 ohms. |

One hundred cells of battery were used in making the tests, one pole of the battery being connected with the water in the jar, the other pole with the copper conductor.

Experience has proved beyond the possibility of a doubt that it is just as fatal to life to come in contact with the covering of the wire when it is wet as it would be to come in contact with the naked copper wire. Two men have recently lost their lives in this city by accidentally touching the covering of an electric light wire when it was damp. The Western Union Telegraph office and the jewelry store of Duhme & Co., in this city, were set on fire at about five o'clock in the evening during a light rain by some one throwing a short piece of wire from a building in such a manner as to make a contact between an electric light wire and a telegraph wire. The electric light company has compromised with the widows of the two men who lost their lives, and the probabilities are that they paid out a sum sufficient to replace all their present wires with well insulated ones. It has not taken them long to see the folly of using uninsulated wires, and they are now renewing the plant with insulated wire. Notwithstanding the fact that the use of uninsulated or "underwriters' wire" has within the past two years caused the death of at least 100 persons, and destroyed property to the amount of over one-half million dollars in the United States, yet we see the new companies all over the country following in the footsteps of the older ones, and subjecting themselves to heavy damages that may result from loss of life and property.

To make matters worse, they attempt to construct their lines parallel with and on the same side of streets with telegraph and telephone wires, and thus bring about litigation that costs them, to commence with, fourfold more than it would have cost to string well insulated wire.

It is apparent to any one that where two sets of wires are strung parallel, one above or below the other, they will come in contact with each other during storms or fires ; in fact, it is impossible to prevent frequent contacts. Whenever there is a contact, it means a fired telegraph office or telephone exchange, possibly death to some employe. Every residence or business block that has a wire of any kind connected with it is liable to be set on fire at any moment by a contact between the various wires which form such a network throughout every city. Telephone employes inform us that it is a very common thing now to find telephones that have been set on fire at night and burned up, the charred remains having fallen to the floor.

It does seem that enough lives have been sacrificed, enough property destroyed, and money lost to bring the stockholders of electric light companies to their senses ; but still the ruinous policy is followed, and there will probably be no relief or change until the various States take up the subject and enact suitable legislation, and not only enact it, but enforce it.

### Arrangement and Protection of Water Pipes.

How shall the water pipes in a house be run and arranged ?

This is, so far as subsequent annoyance owing to the constant necessity of repairs is concerned, one of the most important matters connected with the water supply of a house, and far too little attention is in the majority of cases paid to it by architects and builders. In the first place, it is important that all lead, and also tin lined and block tin, pipes be well fastened to boards or narrow strips of wood nailed to walls or ceilings. Vertical lead pipes should be supported by soldered hard metal tacks to the lead pipes, and fastening them with screws to the board. All sagging is thus effectively prevented, provided the supports are not placed too far apart. Horizontal or graded lead pipes should be firmly supported wherever possible throughout their entire course by strips of wood on which they rest, and must be kept in place by brass bands or clamps. Sometimes it is necessary to fasten horizontal lead pipes to boards nailed to the underside of ceilings. In such a case, the supports must be placed very close together—say every two feet. If insufficiently fastened, lead pipes are soon dragged down by their own weight, besides being affected by changes of temperature, for when hot water passes through the pipe it causes the pipe to lengthen, and hence to sag, while lead does not return to its original shape on cooling. Once out of line, pipes become air-bound, or freeze in winter, and leak.

Hot and cold water pipes should be kept at least one-half inch, and better one inch, apart to prevent loss of heat from one to the other ; and where they run in the same direction, must be fastened truly parallel to each other. Faucets, and in particular ground key and self-closing bibs, should not be placed at the end of a line of supply pipe, where this can be avoided, but should be taken from the side of the pipe, and the pipe suitably continued so as to form a small air chamber.

In arranging a system of service pipes in a dwelling, the cardinal rule should always be observed that all lines of supply pipes be so graded that they may be readily and completely emptied at some stop and waste cock or draw-off faucet when the water is shut off from the house. This is very important in the case of severe cold weather to prevent the freezing of pipes, and is an absolutely necessary condition in the case of all houses left empty during the winter months, such as summer and seaside residences, etc. In this connection it may be well to state that no check valves should, as a rule, be used in lines of supply pipes. Where used, their number and location should be remembered and noted by the house owners, for such check valves interfere with the complete emptying of pipe lines.—*William Paul Gerhard, in Good Housekeeping.*

### The Proper Construction of Stone Houses.

There is no more prolific source of trouble, both to builders and owners of stone houses, than that caused by water penetrating the walls and getting in over the windows after a heavy rain.

The causes producing this trouble being well known, it would seem an easy matter to overcome them, and all sorts of suggestions to that end have been made, but so far with no effect.

The present time, therefore, would seem an opportune one in which to offer a practical solution of this trouble, and that is the purpose of this article. The underlying cause of all this trouble is haste to finish the building ; hence, the first thing to be done, and without which all else is practically useless, is to "make haste slowly." Time should be given the mortar to harden, the building to settle, and the cracks to show before the pointing is done. No stone house should be pointed the same year it is built, for two reasons : First, the cement used in pointing forms a barrier to the evaporation of the moisture in the mortar in which the stone is laid, and prevents it from drying. The pointing, while keeping the moisture from coming out, will not prevent the frost from going in and freezing the mortar ; this will produce an expansion, which causes the pointing to lose its grip on the mortar, and creates innumerable crevices through which the water easily finds its way. Secondly, all stone buildings, even when built in the most careful manner, have a tendency to settle. This settlement cracks the pointing. In many cases these cracks are so fine as to be scarcely visible, especially if some distance from the ground. But no cracks are too small for water to penetrate, driven by the force given it by the wind from an open sweep of miles, as it has in many parts of this country. It is absolutely essential, therefore, that the mortar should have time to evaporate all its moisture and become thoroughly dry, and the building time to settle, before pointing.

Houses built with stone, and having all the windows arched solidly through the entire thickness of the wall with brick, seldom have water dropping from the soffit of the frame ; for if any water should beat through the stonework or cracks in the same, the bricks, having power to absorb so much of the water, hold it while the rain lasts, and after it is over evaporate it to the outer air.

When impracticable to use brick over the windows, from architectural or other reasons, a piece of sheet lead, going through the entire thickness of the wall, and extending about one foot each side of the window, and turned up two inches on the inside, will hold the water until it evaporates.

A style of architecture much in use at this time necessitates exposed gables. These gables are usually finished so late in the season that the mortar has not time to dry before the frost sets in, and in consequence the mortar freezes. Mortar once frozen loses its adhesiveness, and therefore has no life in it. The proper and only safe plan is to use Portland cement and sand (no lime) in all gables. This will set in one-tenth the time of lime mortar, and will be hard and dry before frost comes.

All stone gables that rise above the roof, and are only protected by stone coping, should have a sheet of lead to cover the entire wall put on under the coping. This lead should project over the inside of the wall, and be turned down over the flashing of the roof. By this means, all water that gets through the joints of the coping will be carried off. In conclusion, with care and a proper observance of the natural laws governing the materials used in its construction, a stone building can be built in the present day just as tight as years ago, when people did not expect to excavate the cellar in the spring and move into the finished house in the fall.—*The Builder.*

### Orthochromatic Photo Plates.

According to the *Photographische Mitarbeiter*, the following is the recipe for orthochromatic gelatine plates as given by Dr. Mallmann and Ch. Scolik. The plates are first dusted with a soft camel's hair brush, and placed in a bath containing :

| | |
|---|---|
| Water | 200 c. cm. |
| Ammonia | 2 " |

in which they are allowed to remain for two minutes. They are then taken out, and after draining are immersed in the following solution :

| | |
|---|---|
| Erythrosin solution (1 to 1,000) | 25 c. cm. |
| Ammonia | 4 " |
| Water | 175 " |

for 1 to 1¼ minutes, the dish to be kept covered and in motion. Both baths can be used for a dozen plates, but after the seventh or eighth 1 c. cm. ammonia should be added to both solutions. The plates are then taken out, and allowed to dry in a perfectly dark room. This is accomplished in about three hours. Care should be taken against overheating. With these plates the alkaline pyrogallic developer should be used. If the oxalate of iron developer be employed, veiling is the result.

### Moses Albert Slaven.

On Tuesday, September 14, 1886, this well known engineer and contractor died at his home in this city. He was a native of Canada, and was forty years old. He went to California, and did much work in San Francisco as a master builder. Coming to this city, he, with his brother and others, founded the American Contracting and Dredging Company, that is now working its contract with the Panama Canal Company for the removal of 30,000,000 cubic meters of soil, about one-fourth of the entire excavation. The progress of this work and the dredging machinery have been described in these columns.

### Milk as an Odor Absorbent.

Those dairymen who do not believe in the power of milk to rapidly absorb and become contaminated by surrounding noxious smells will do well to try the following simple test, the results of which will, doubtless, immediately convince the most skeptical : Take a wide bowl or soup plate to the cow stable when you go to milk ; pour into it a pint of fresh milk, set it on the floor or at the height of a milk stool, so as to expose it fully to the air of the stable, behind and close to the cows. If the day is close and heavy and the milk is cold, and the stable not cleaned out and aired, the result will be surprising. Take it to the house or anywhere away from the stable, and try to drink it.

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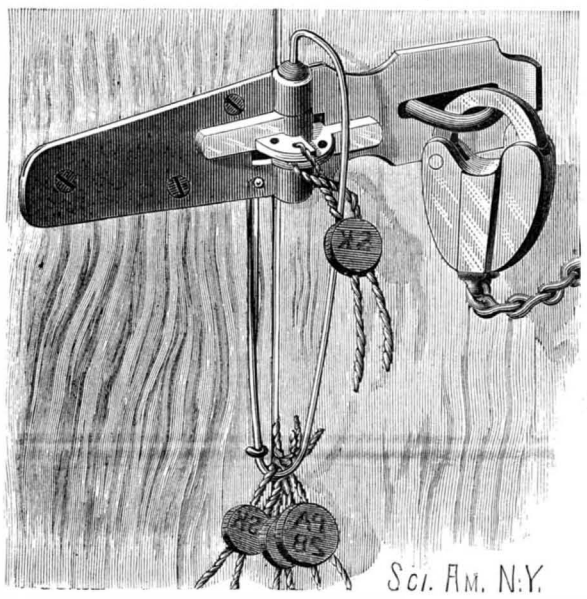
### SEAL LOCK.

The invention herewith illustrated consists mainly of a seal for car doors, provided with a receiving wire or holder for retaining the seal after it is broken. The holder is placed in line with the hinge of the hasp, and the seal is applied to lugs attached to the plate and hasp as shown. These lugs are correspondingly perforated for the passage of the sealing wire, the perforations being countersunk to form opposing cutting edges, so that the opening of the hasp will cut the sealing wire. The holder is attached at one end to the plate of the hinge and at the other to the hinge pintle, so that it requires no extra attachment, except a staple, to hold its lower portion. In applying the seal,

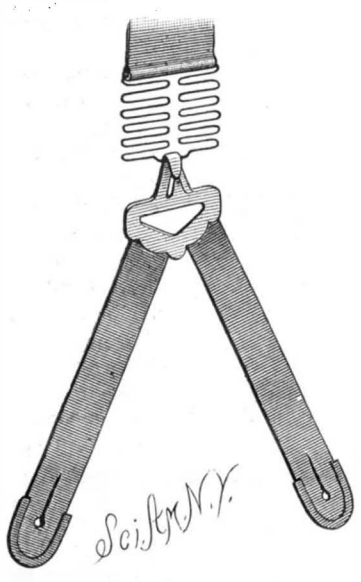



ALLEN'S SEAL LOCK.

the wire is passed through the perforations and tied next to the lugs. The ends of the wire are then brought out, one on each side of the holder, and the seal applied outside of the latter. The seal is then closed with pinchers, which at the same time impress into the seal a figure indicating the station at which the car is locked. When the hasp is opened, the wire is cut and the seal drops to the bottom of the holder, where it will be retained. In case the car is opened several times, there will be as many seals upon the holder, each with a different mark, so that the seals show the number of times and places at which the car was opened.

This invention has been patented by Mr. S. E. Allen, of Winston, N. C.

### METALLIC SPRING FOR SUSPENDERS.

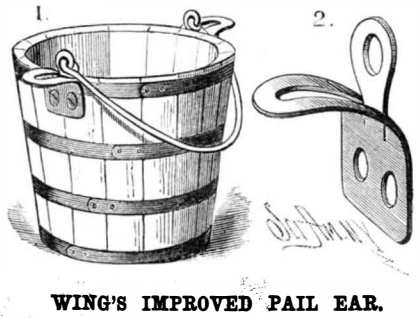



The spring is formed of wire bent to form two parallel series of flat loops, as clearly shown in the engraving. The shoulder strap is secured to the upper loop, and the ends or button pieces are provided with a hook, by which they are connected with the lower loop. This forms an elastic and durable spring of neat appearance.

This invention has been patented by Mr. John M. Sauder, of Harrisburg, Pa.

### IMPROVED PAIL EAR.

This pail ear provides a support by which the milkman can readily hold the pail while milking, thereby preventing it from coming in contact with the ground, and also guarding against its being tipped over. The ear is formed of sheet metal, bent and perforated as shown in the enlarged view, Fig. 2. The curved arm




WING'S IMPROVED PAIL EAR.

projects outward away from the pail, and forms a convenient support, which may be received upon the knees of the milkman, and which will readily sustain the pail without the necessity of exerting a great pressure upon the sides. This pressure, in the case of sheet metal pails, is destructive, besides involving an undesirable amount of labor in holding the pail while milking. The vertical apertured ears receive the bail by which the pail is carried.

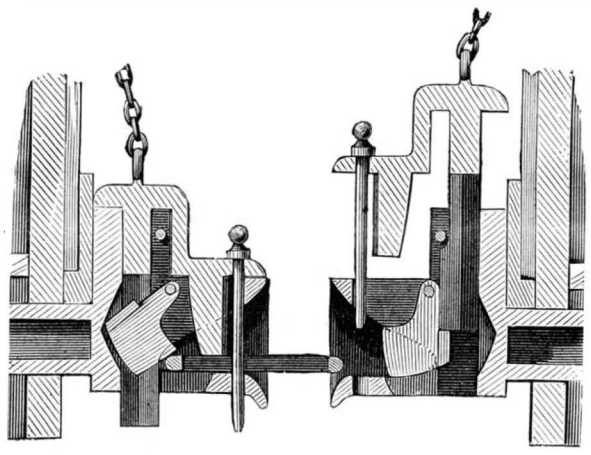
This invention has been patented by Mr. George S. Wing, of Alexander, N. Y.

### Compression of Water.

For the measurement of very high pressures, M. E. H. Amagat has adopted the principle of the manometer with differential pistons. In order to obtain accurate results, the condition had to be realized of maintaining the pistons in complete action while keeping them perfectly airtight. The reading of the volumes of compressed fluid was effected by the process already indicated by Prof. Tait, of Edinburgh. Water and ether have been studied at zero and at the two respective temperatures of 20° and 40° C. Respecting the variation with pressure, it is shown that the coefficient diminishes gradually with the increase of pressure, and this takes place throughout the whole scale of pressures, contrary to the opinion of some physicists. At 3,000 atmospheres the volume of water was reduced one-tenth, and its coefficient of compressibility one-half.

### CAR COUPLING.

The drawhead herewith illustrated is provided with a recess in its top and with apertures in the bottom. Swinging upon a transverse pin in the top of the drawhead is an angle piece, provided at its angle with inclined side lugs. On top of the drawhead is a plate, shaped as represented in the engraving, and having a downwardly projecting lug, formed with a longitudinal slot and groove to receive the angle piece. The front of the plate is perforated to receive the coupling pin. This plate and pin are supported in a raised position, as shown in the right hand view, by the lower end of the grooved lug resting on a shoulder formed on the angle piece. The en-



HOOVER'S CAR COUPLING.

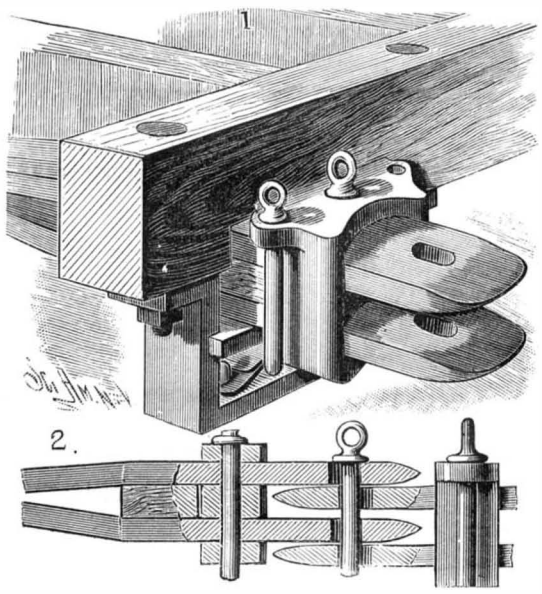
tering link of the other car strikes the front end of the angle piece and swings it inward, allowing the top piece and its pin to drop and couple the cars. This is shown in the left hand view. When the plate is raised, the angle piece automatically swings under the lug and adjusts the parts ready for coupling. Just back of the hole for the pin in the top plate is a downwardly projecting arm, of such length as to rest upon and hold the link in a horizontal position, to insure its easy entrance into the opposite drawhead. The plate may be operated from any desired place on the car by attaching a chain to the eye secured to its top. This coupling, which is the invention of Mr. George W. Hoover, of Keithsburg, Ill., is very simple in construction, and automatic in operation.

### New Retting Process for Flax.

M. Parsy, at a recent meeting of the Industrial Society of the North of France, published a very interesting paper on his new method of retting flax, according to which the pectose that envelops the cellulose fibers in the green plant is transformed into pectic acid, which constitutes in retted flax the brilliant part of the fiber. This transformation can also be effected by placing the flax in a closed vessel (autoclave), in which water at 150° C. is introduced for the space of a few minutes only, and which is followed by steam at the same temperature. The whole operation only lasts one and a half hours, during which the flax loses from 20 to 25 per cent of its weight, as by the ordinary retting process, but on leaving the apparatus it contains less water, and is consequently more easily dried. M. Parsy can, by modifying the process, give the bluish or yellowish color to flax. For the blue he employs the water of a preceding operation, slightly acidulated by the organic acids of the flax which go in solution; for the yellow he employs water slightly alkaline. At the same sitting another gentleman came forward, stating that he was also the inventor of a new retting process, of which, no doubt, we shall hear at some future time.

### CAR COUPLING.

The car coupling herewith illustrated is the invention of Mr. H. A. Springer, of El Moro, Colorado. In a recess in the end sill of the car are placed two similar drawbars, whose forward portions are held apart by a block, as shown in Fig. 2, and whose rear ends are brought together and pinned to the end of a drawbolt provided with the usual spring. The buffer block is made with mortises to receive the drawbars, to which it is detachably secured by a pin. The face of the buffer is concaved and the sides of the top are extended to receive apertures, in which extra pins are carried. The front of the drawbars is supported by a carrier which is pressed upward by a




SPRINGER'S CAR COUPLING.

spring and is adapted to slide upon the vertical sides of a yoke suspended from beneath the car. This coupler will couple as well upon a curved as a straight track, as the eyes in the drawbars will register at almost any angle; the tapering points of the bars, together with the concaved face of the buffer, admit of ready coupling when one car is higher than the other. Should a drawbar break, another can easily be put in its place. The coupling pin is not liable to breakage, as the strain is distributed along its length.

### Disasters at Sea.

Twenty-six shipwrecks were reported during the first week of September last, twenty-two being British owned. Four were British steamers. Off the British Isles, nine vessels (all British, including three steamers) went down. Out of twenty collision cases reported, three vessels (two British and one Swedish) sank, the British sinking off the British Isles. Four vessels were destroyed by fire. Total wrecks for year, 932.

### SOLDERING CASE.

This case forms a compact and convenient receptacle for the various articles constituting a solderer's kit. Formed in the top of the block is a compartment to hold the solder, and also a groove extending along one side to receive the shank of the soldering iron. Pivoted to the top is a lid which, when placed parallel with the block, serves to hold the solder and soldering iron in place, and which, when turned to one side, allows either the solder or iron to be removed. When not in use, the acid bottle is held in a recess in the upper end of the block, but when needed it is placed in a hole in the upper face of the block. As here illustrated, the acid bottle is secured in the end of a piece pivoted at its opposite end in a right angle recess formed in one corner of the block. The pivoted end of this piece is beveled, so that when the bottle is needed it may be turned to an upright position. When not needed, the piece is folded down parallel with the block, as indi-

MORNINGSTAR'S SOLDERING CASE.

cated by the dotted lines. Upon one edge of block is a hook for holding the heated soldering iron.

This useful soldering case is the invention of Mr. Sylvanus Morningstar, of Newhamburg, Ontario, Canada.

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### Cast Glass Rails.

Friedrich Siemens, of Dresden, has succeeded in casting glass in the same way as metal is cast, and obtaining an article corresponding to cast metal. This cast glass is hard, not dearer in production than cast iron, and has the advantage of transparency, so that all flaws can be detected before it is applied to practical use. It will be much less exposed to injury from atmospheric influences than iron. The process of production is not difficult, the chief feature being rapid cooling. The hardness and resisting power of this cast glass are so great that experiments are being just now carried out at the Siemens glass foundry at Dresden with the purpose of ascertaining whether the material could be employed for rails on railways.

A sample of these glass sleepers recently tested at the Anderston Foundry Company (Limited), Glasgow, resisted a falling weight of 3¾ cwt., falling upon a rail placed upon the sleeper set in sand ballast, commencing at 6 inches and rising by succeeding increments of 6 inches up to 9 feet 6 inches —the *maximum* elevation to which the test ram could be elevated—without effect until the blow had been repeated for the sixth time. Cast iron sleepers are expected to withstand a similar test up to 7 feet only. The cost of glass sleepers will be considerably less than that of either cast iron or steel, while the material is practically imperishable as regards climatic changes and influences, or the ravages of such insects as the white ant.

### FLOODS IN INDIA.

West of the River Jumna, the Northwestern State Railway runs parallel to the Himalayas for some hundreds of miles, and crosses all the five rivers of the Punjab. The country between the hills and the railway is more or less subject to floods throughout the whole of this distance. In the neighborhood of Umballa there are several mountain torrents whose wide sandy beds are dry for nine months of the year, but during the remaining months, whenever there is heavy rain in the lower ranges of the Himalayas, they become broad, rapid rivers, which are eventually lost in the sands of the Bikanir deserts.

The railway crosses the beds of these streams on iron girder bridges, apparently wide enough to carry off the waters of any flood. On the 3d of July an extraordinary spate came down the Markunda and other neighboring rivers between Umballa and the Jumna, and as the bridges were unable to pass all the water, the floods spread all over the country. The railway embankment, which is generally eight or ten feet high, acted as a dam and kept the water back, so that it accumulated, and at last ran over the top of the bank in places. Wherever this happened, a breach in the embankment was invariably caused. Some of the smaller bridges, and culverts, too, were washed away, and holes twenty feet deep scoured out in the places where they had been. In one place there was an almost continuous breach in the railway for more than a mile; ten miles further on there were others very nearly as extensive, and lesser breaches between these two points. But, although the bank was gone in so many places, the rails, with their cast iron sleepers, were left hanging in festoons in the air, and were only actually broken in one spot. Of course, all running of trains was suspended; but the mails had to be got through. The sketch represents the English mail *en route* for Simla being carried on trollies over the damaged portions of the line. The railway was not the only sufferer; the Grand Trunk Road, which runs parallel to it, was destroyed in places, and many villages were wholly or partially washed away.

To restore through traffic, it has been necessary to construct an entirely new portion of line to one side of the breaches, the repair of which will take a considerable time. The above account is by Captain William Pitt, R.E., who has also furnished the sketch.—*London Graphic.*

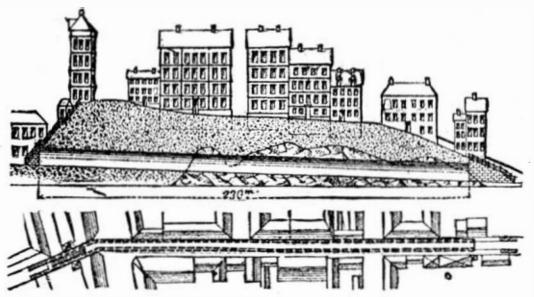


Fig. 2.

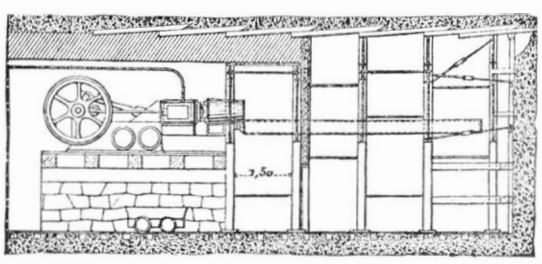


Fig. 3.

### TUNNELING BY FREEZING.

Pœtsch's ingenious system of sinking mine shafts through watery earth by freezing the latter is already known to our readers. An attentive examination of the frozen strata having shown that their respective slopes had but little influence upon the total hold of the mass, it was concluded that no special difficulty would be met with in applying this method of the driving of a tunnel. This opinion has held good in practice, and, although merely the principle of the method has been employed in the tunnel that has just been opened at Stockholm (Fig. 1), we have here an interesting example of the practical solution of the question of tunneling in shifting earth. The tunnel in question is designed to unite two quarters of the northern part of the city that are separated by the crest of a hill which renders communication between them particularly difficult. In order to overcome this difficulty, Capt. Lindmark, of the Swedish Engineers, proposed to tunnel the hill. The total length of the work is 755 feet, the width is 13 feet at the springings, and the height 12½ feet under the key. In order to avoid taking possession of private property at the approaches to the mouths, the line was carried in the direction of the axis of a street; but this latter was already laid out and was quite narrow, and in certain parts, especially near the western extremity, the foundations of the tunnel came under those of the houses (Fig. 2). Such a work therefore presented peculiar features, and required the greatest precaution in order to prevent the subsidence of the structures above.

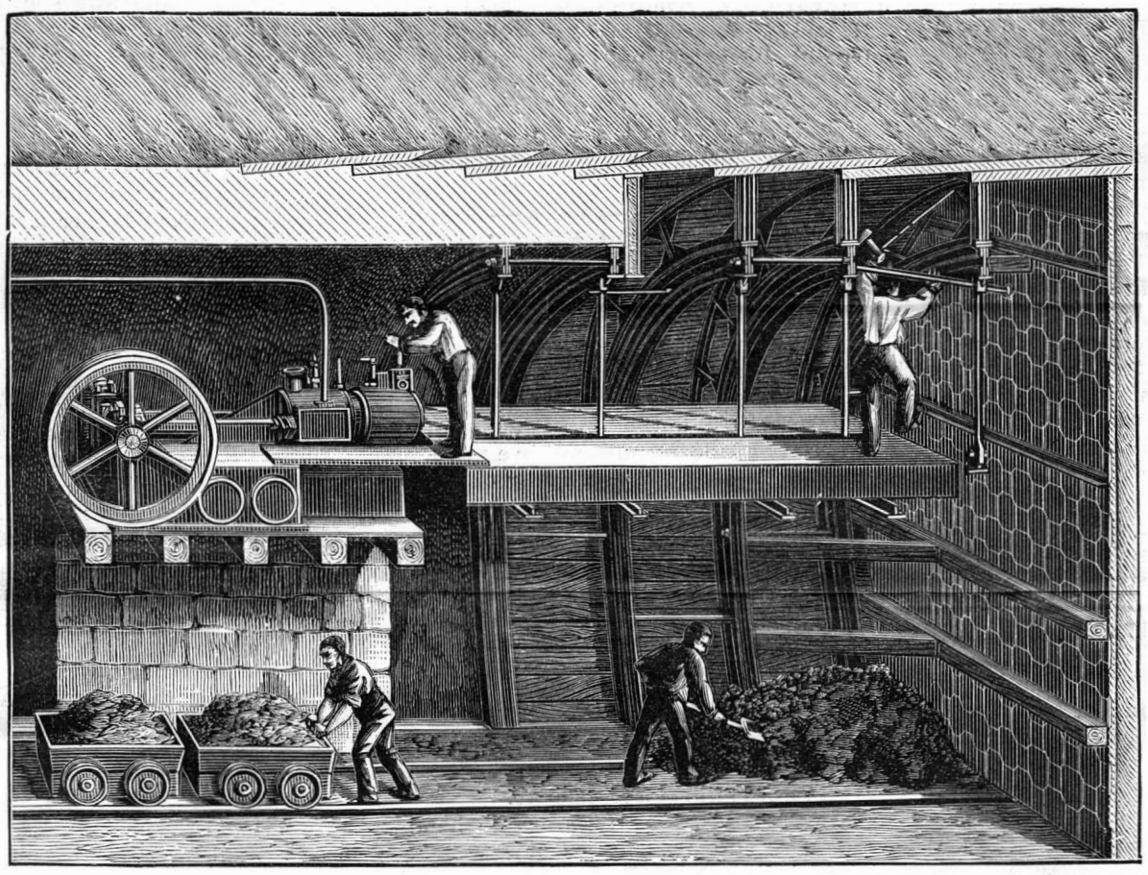
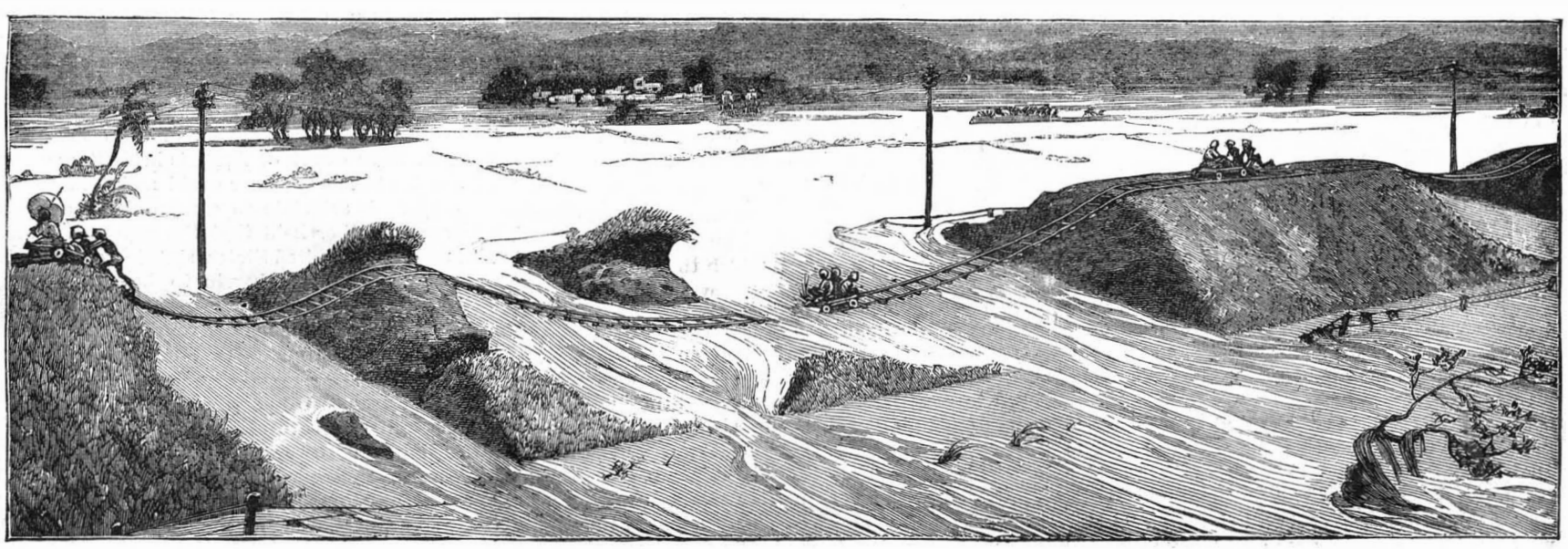


Fig. 1.—TUNNELING BY FREEZING.

The direction heading at the base of the tunnel was for the most part excavated in granite by means of dynamite. The widening out of the western part of the work met with no serious obstacles, but it was entirely otherwise with the eastern. The ground met with near the mouth consisted of coarse gravel intermingled with blocks of stone and cemented with a clay that became liquid through infiltrations of water, and caused the sand to flow through even the smallest apertures. Moreover, at fifteen yards from the mouth, the line passed under two five-story houses (Fig. 2), built upon the opposite sides of the hill, and at so slight a distance from each other that the arch butments of the tunnel had to be built under their foundations, which latter extended down to within ten feet of the arch.

Mr. Lindmark, in the first place, thought of the method devised by the Austrian engineer Rziha, which consists in supporting the sides of the excavation with two centerings, one consisting of voussoirs of Vignole rails connected by bolts and stays, and the other of cast iron, formed of pieces of double T section, upon



CARRYING MAILS ACROSS THE NORTHWESTERN STATE RAILWAY, INDIA, DURING THE RECENT FLOODS.

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which rest the upper voussoirs. Planking is placed against the way-head, and is kept in position by jack-screws. In measure as the excavating progresses, centerings are placed in the space prepared in advance, while those which have become useless are taken down and replaced with masonry. Such precautions in this case proved barren, and, after some subsidences had occurred before reaching the locality beneath the buildings that we have spoken of, it became necessary to stop work at about twelve yards from the mouth.

It then occurred to Mr. Lindmark to employ freezing, and, to this effect, he set up in the tunnel a cold air machine of the Lightfoot type, that furnished 25,000 cubic feet per hour of air at a temperature of —20° C. Fig. 3 shows the arrangements adopted, and combined with the Rziha method. After a run of sixty hours, a freezing of the sides of the tunnel was effected, and it then sufficed to run the apparatus ten hours during the night to keep up the solidification of the mass to depths varying from five feet to the level of the floor. Toward the key, the thermometer did not indicate more than 0°, while the mean temperature was —4½° C. The temperature rose rapidly to 0°, however, when the laborers began to work. The working chamber was closed by a double partition, which was filled in with charcoal, and which was moved forward in measure as the excavation advanced five feet. The metallic centering, arranged as before, but diminishing from the parts corresponding to the archbutments, was put up against the sides that had become solid. The difference in temperature between these parts and the arch presented no inconvenience; it even permitted of easily sinking the sheet piling, which would, in any event, have had to be used, and the driving down of which into frozen gravel would have been difficult, if not impossible.

In measure as a 5 foot section was completely excavated, the masonry was built up behind the partition; advantage thus being taken of the time during which the walls still remained solid. The operation was carried on in this way for a distance of eighty feet, beyond which there was encountered soil of sufficient cohesion to render freezing useless.

The work, which was begun in the summer of 1885, is now completed. Of the two houses under which the tunnel passes, one has exhibited no subsidence, while the front of the other has settled about an inch. But the construction of this front leaves much to be desired, and fissures could be seen in it before work on the tunnel was begun. The work cost $88 per running foot.

Such an application of the principle of freezing earth might doubtless be made in the work on the Metropolitan Railway of Paris, which, at a certain number of points, has to traverse ground that is more or less watery, and that, at all events, supports high buildings, without speaking of that part of the line which, joining the two banks, runs as a tunnel under the bed of the Seine. It is probable, moreover, that a series of applications made upon a large scale, and the cost of which would be distributed over quite long stretches, would permit of reducing the cost noted above for the Stockholm tunnel, where the expense of purchasing and setting up the cold air apparatus must have weighed quite heavily upon the work as a whole.—*La Nature.*

[For additional particulars and illustrations of this work, see SCIENTIFIC AMERICAN SUPPLEMENT No. 542, May 22, 1886.]

### An Electric Boat Crosses the Channel.

On Sept. 13 last the electric boat Volta crossed from Calais to Dover and back again under the propulsion of power stored in secondary batteries. The double trip was made with a single charge, which proved amply sufficient for the purpose, and was in every way successful, although it is not very clear that it demonstrated anything more than could have been shown by a run in the Thames or the Solent. The boat passed the pierhead at Dover at 10:41 A. M., and made the pierhead at Calais at 2:32 P. M., the run having occupied 3 hours and 51 minutes. The return journey was made in 4 hours 23 minutes, the total running time being thus 8 hours 14 minutes. The distance each way, we believe, is 22 miles. This, says *Engineering*, is no great speed, far below the maximum of which the boat is capable, but it was necessary to economize the power in view of the possible contingencies which might arise. Three different speeds can be obtained by various groupings of the two Reckenzaun motors which are employed. These motors are both on the same shaft, which they drive direct. For the slow speed the motors are coupled in series, the current passing through them in succession, and driving them at about 600 revolutions per minute. For the medium speed only one motor is employed, while for the fast speed they are placed parallel, thus affording two circuits to the current.

Under the last condition the speed of rotation is 1,000 per minute, and the brake horse power 16. The motors drive a three-bladed screw, 20 in. in diameter and 11 in. pitch, coupled direct to the main shaft. The motors measure together 3 ft. 10 in. long, by 1 ft. 9 in. wide, by 12½ in. high, over all. They weigh 730 lb., and are worked by 61 E. P. S. cells, weighing about two tons, and each giving one horse power for one hour. On Sept. 13 the battery gave a current of 120 volts and 28 amperes, which was maintained constant until Dover was nearly reached on the return journey, when it had fallen to 24 amperes. The boat, which was designed and built by Mr. Skelton, of Millwall, measures 37 ft. by 6 ft. 10 in. It carried a party of ten, among whom was Mr. Reckenzaun and Mr. Stephens, of the firm of Stephens, Smith & Co., who have supplied the machinery. The noticeable feature in this trip, as in all previous experiments with electric boats, was the perfect stillness of its passage through the water. It is remarkable that the wonderful superiority in this respect over the noisy, puffing steam launch should not already have led to the general use of this method of propulsion for purposes of pleasure.

### A Small Locomotive.

Probably one of the smallest and most perfect working models of a locomotive is now on exhibition at the American Institute Fair; it is only one thirty-second the size of the ordinary engine, and yet every detail is accurately represented on this standard. The engine was designed and built by Mr. F. Van Fleet, of Williamsport, Pa., during such time as he could spare from mercantile pursuits, and is a rare example of fine mechanical skill. The building occupied from three to four hours a day for two and a half years. Mr. Van Fleet's only mechanical training was obtained during two years spent at Cornell University; he never worked in a shop, nor has he had any practical experience with machinery, so that the mechanical perfection of his work as shown by his locomotive indicates much genius. His knowledge of the locomotive was obtained by several years of study of books and close examination of engines of various patterns. The miniature locomotive is not copied from any of the large ones, but contains their best features, and constitutes Mr. Van Fleet's ideal of a locomotive.

All the work was performed with hand tools—taps, dies, files, etc.—the only machine used being an ordinary foot lathe. All the valves and pistons were ground, the latter so accurately that, although they will slide of their own weight, they form a steam-tight fit with the cylinders. This accuracy of fit was necessary, since the smallest leak, where the pipes were so minute, would prevent the working of the engine. Some of the pipes measure only one-sixteenth of an inch in diameter outside, and have a bore of one thirty-second of an inch. These were made of thin sheet copper, which was drawn through dies until the proper size was attained, when the meeting edges were soldered.

The length of the engine and tender is 19 inches, the former being 12 inches; the height is 5½ inches, and the width 3½. The cylinders are nine-sixteenths inch in diameter by three-quarters inch stroke. Steam enters the cylinders through ports one-sixteenth by three-eighths of an inch, and makes its exit through ports three thirty-seconds by three-eighths of an inch. These ports are opened and closed by slide valves one-quarter of an inch wide and three-eighths of an inch long. The driving wheels are 2¼ inches in diameter, the truck wheels three-quarters, and the tank wheels thirteen-sixteenths. The main rods are 2¾ inches long, and the side rods 2⅞ inches long and one-eighth inch in width. The boiler is 1½ inches in diameter and 10 inches long, including the extended smoke box; the fire box is 2½ inches long by 1½ wide. One large flue extends through the boiler, it being necessary to make it this way, since the draught would have been choked had the number and size of the tubes found in the ordinary locomotive been followed. The boiler is built of brass lagged with wood and jacketed with Russia iron bound with German silver straps. The steam dome is 1 inch in diameter and 1½ in height, and is provided with two safety valves, a "pop" and lever, and with the usual whistle. The boiler will safely bear a steam pressure of 125 pounds, although the steam gauge, which is one-quarter of an inch in diameter, and whose face is illuminated by a genuine lamp placed directly in front of it, will only indicate up to 100 pounds. The engine is equipped with a perfect "Sellers improved injector" 1¼ inches long by one-eighth of an inch in diameter. It is also fitted with a full Westinghouse air brake system, both automatic and straight, on drivers and tank. The air pump is 1⅜ inches long and three-sixteenths in diameter. The driver brake cylinders are three-eighths of an inch long and one-quarter in diameter. The steel links are $\frac{11}{16}$ inch long, and have a slot three thirty-seconds of an inch wide; the link block one-eighth by three-sixteenths inch. All the nuts are hexagonal, and there are 120 threads to the inch in the bolts. The stack is one-half inch in diameter by two in height, and is provided with a headlight five-eighths inch in diameter; one filling of this lamp with oil will illuminate the track for one hour. The signal lamps are one-half inch long, and will burn twenty minutes. The engine is provided with a very perfect steam reversing gear designed by Mr. Van Fleet. The weight of the engine is about 15 pounds. It can be fired and run the same as the ordinary locomotive, and is fitted to burn either oil, coal, or coke. Lubrication is provided by oil cups one thirty-second inch bore.

In constructing this locomotive, no complete drawings were made; the separate parts were taken up, fitted in place, and finished, only such drawings of the details being made as were found necessary. The engine is beautifully finished, and the skill of the builder is shown by the perfection and accuracy of each part, even those which are partially hidden showing the same care and skill. The materials entering into the construction of the engine are gold, silver, German silver, brass, copper, steel, iron, and nickel.

### Seeing and Thinking.

Some men, remarks a contemporary, would walk through a machine shop and see nothing but lathes, planers, and other machine tools, together with a lot of unfinished castings and pieces of machinery. Such men never improve methods of doing work. They never think of a better way to do a job. They plod along, thinking chiefly of killing time until pay day. Now and then a man comes along who sees things differently. No matter what object meets his eye, the sight of it suggests something. Perhaps the object is nothing but a piece of scrap iron lying on a junk heap. No matter, our "observing man" sees the whole of that piece of iron, and it stirs up numberless thoughts and calculations as to how that piece was worn out, and what made it wear in that particular manner, and how it could have been made to wear much longer. Perhaps the observing man finds an awkward tool expensively employed in doing a job in an indifferent manner. Our seeing man realizes in an instant the disadvantages of that particular tool, and at once sets to better the matter. A piece of bent iron, a twisted wire, or some commonplace object often gives the impressive mechanic a clew to some point upon which he has been studying for a long time. These men are the ones who make improvements. They are the kind of men needed, and all men should follow their example of trying to see all there is in everything which comes to view, no matter how insignificant or commonplace it is.

### Destruction of Our Birds.

Twenty to thirty years ago, it was not an unusual sight to see even the scarlet tanager, a bright red bird with black wings and tail, flitting from tree to tree in the heart of our cities like a fiery meteor in the sun light, and to find their nests, built very lightly of straws and similar material, on the horizontal limbs of our shade trees. But they were killed off and driven back to the woods long before the advent of bird millinery as a fashion. They were, indeed, a "shining mark," and everybody wanted a specimen, or thought they did, until at the present time the scarlet tanager is really a very rare bird throughout the New England States.

The Baltimore oriole, so named because the colors of the bird, black and yellow, resembled those of Lord Baltimore, has almost met the same fate, as it has done duty in ornamenting thousands of ladies' bonnets within the past five years. Four years ago, this bird was quite plenty on the elms of Boston and suburbs. The hanging nests, made of hemp, old twine, etc., were quite common. But the past season showed a great change. These birds have been shot so ruthlessly, both while here and at the South, and during the migration, that hardly a pair could be found during the breeding season of 1886. The ragged nests are occasionally seen, belonging to years gone by, as it sometimes takes the storms of many winters to beat them to the ground. If the different societies organized to protect our native birds do their whole duty, these beautifully plumaged insectivorous birds will soon become common once more. JOS. M. WADE.

### Agreement Relating to Unpatented Inventions.

A partner persuaded his copartner to agree to pay the expenses of experiments to perfect an invention made by a third person, in consideration of a share in the results. The firm paid the expenses of the experiments, and afterward the first mentioned partner and the inventor took out a patent for the invention in their joint names, to exclusion of the other partner. The New York Court of Appeals held (Burr vs. De la Vergne) that the copartner could maintain an action to compel his associate to carry out the agreement. The court further held that the agreement was not void under the United States statute requiring every patent or any interest therein to be assigned by an instrument in writing, on the ground that the agreement related to an inchoate invention not perfected or patentable at the time the agreement was made.

PROF. EDWARD ORTON gives the following as the charges for use of natural gas at Bowling Green: For house lights, 20 to 30 cents per month; cooking and heating stoves, $3 per month in winter. At Findlay: For cooking stoves, $1 per month is charged; for sitting room stoves, $1.50 per month; for grates, $2 and $2.50 per month; for house lights, 15 to 30 cents per month; for boilers, $150 and upward per year.

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## Correspondence.

### Image of the Sun as a Measure.

*To the Editor of the Scientific American:*

I noticed in the SCIENTIFIC AMERICAN for October 2, 1886, the following communication from a Mr. Shields, of Coopwood, Miss., in which he gives a method for determining the permanent length of an inch as a unit of measure: "Take a plain mirror, on the equator, at noon on any certain day, and get the size of the sun's disk, which will be about an inch. This will be the same size on any meridian at noon, and unchangeable."

I would beg leave to state some objections to his method of arriving at this standard unit of length:

1st. According to the theory of contraction, the sun's diameter is diminished about 220 feet per year, or about 4 miles per century. Therefore, the diameter of the sun is not a constant quantity. This fact alone would make it theoretically not correct.

2d. If you tried to find the exact diameter of the sun's image in a mirror by traveling around the equator, it would vary, because the sun is not always exactly vertical on all parts of the equator. It is only vertical on two points.

3d. The personal equation with different persons would vary, and therefore render the unit of length derived in this way variable. GEO. I. KING.

York, Pa., Oct. 7, 1886.

### Lime and Cement.

*To the Editor of the Scientific American:*

In your issue of the 9th inst., page 231, you print an article entitled "Cement in Ireland," signed by one Robert Mallet, F.R.S., in which he states that Henri Sainte-Claire Deville, the illustrious French chemist, in the course of certain recent researches discovered that some certain compounds of hydrate of lime and hydrate of magnesia afford a cement of eminently hydraulic qualities, setting rapidly under water; that the natural dolomites, if calcined at a very low red heat and ground to powder, produce, without any other treatment, a fast setting hydraulic cement, which becomes so hard that it may be employed as an artificial stone.

Mr. Mallet further adds: "The process which has been given to the world by Deville is hampered by no patent."

The process is not confined strictly to dolomitic rocks. Any magnesian limestone will answer the purpose fully, so Mr. Mallet states. Every few years some one discovers (!) that an eminently hydraulic cement can be produced from pure magnesian limestone; and, singularly enough, the discovery is invariably given to the world free. It is never "hampered with a patent."

This story generally follows in the wake of the sea serpent story that we always like so well to read about. It is always fresh, always inspiring.

Probably three-fourths of the quicklime manufactured in this country is derived from the magnesian limestone formations. When this stone is calcined sufficiently to expel the carbonic acid, it is called quicklime; and when water is applied it gives off heat, expands, and falls to powder. It is then a hydrate of lime and hydrate of magnesia.

In this condition it is mixed with sand and water, and becomes mortar for masonry and plastering. The lime and magnesia are not chemically combined. It is simply a mechanical combination when in a pure state. They are both bases, containing no acid with which to form a salt.

Taken singly or together, neither of them contains the slightest trace of any setting or hardening properties.

They are, however, the bases that when intimately mixed with certain proportions of silica or silicic acid, and subjected to a high heat, produce silicates of lime or lime and magnesia, *i. e.*, a hydraulic cement.

When water is applied to these silicates, they crystallize and harden, whether in air or water, and will not dissolve by the action of water, while pure lime and magnesia, either singly or as a dolomite, will dissolve in water—will be taken up and held in solution. This result cannot be changed by any manner of calcination or subsequent manipulation.

Not long ago an article appeared in one of the trade journals stating that "the only way to produce silicate of lime was to mix common white or quicklime and sand together with water, and pile it up in a heap, and at the expiration of two or three weeks the whole mass would have become silicate of lime." This idea seems to be quite prevalent, but its absurdity is easily exposed; for, no matter how old the mortar may be, if the lime was pure and white, a few days' immersion will dissolve the mortar, thus proving conclusively that there is no chemical combination between the sand and lime.

A true silicate of lime cannot be dissolved by water. Impure limes, such as the gray or brown limes, always contain silica. Five to six per cent will not prevent active slaking, and the resultant mortar will contain 15 to 18 per cent of true silicates, and even this amount will tend greatly to the hardening of the mortar. It was probably through the use of these impure limes that people have been led to imagine that pure limes contain inherent setting properties—a theory that never has and never can be sustained. U. C.

Buffalo, Oct. 12, 1886.

### The Total Solar Eclipse of 1886.

A correspondent of the London *Times* gives a brief general account of the results of the recent British expedition to Grenada, South America, from which we take the following:

In the eclipse observations secured in Grenada and Carriacou, a distinct advance has been made. New facts have been acquired, old views have been satisfactorily tested, new instrumental methods have been studied, and records of the general phenomena have been secured.

As to the new facts. For these we have to refer to the work of Prof. Tacchini, at Boulogne. No one was more competent than he to note the prominences and other appearances visible during the eclipse. This he did with a 6 inch; and so soon as the clouds permitted after the eclipse, he observed the spectrum of the prominences by the ordinary method. He found that the prominences seen under these two different conditions and by means of such different methods were not the same. He also noted that the prominences seen during the eclipse itself had the same characters as the so-called "white" prominences which he observed in 1883 at the Caroline Islands. These appear whiter and dimmer as the distance from the photosphere increases. These observations have been very closely examined by Prof. Tacchini and Mr. Lockyer, with the result that both these solar observers are now prepared to ascribe these new phenomena to the descent of relatively cool material.

It is difficult to overestimate the importance of this result from the point of view of solar theory. The determination of the direction of the currents in the solar atmosphere is indeed so important that it was included in the programme of the observations to be made by Mr. Turner with his 4 inch finder, but no certain results were secured by this means, as the structure of the corona was apparently unusually complicated. In the spectroscope, however, one long streamer was observed to be much brighter near the limb. This is not absolutely conclusive evidence, but it has its value.

To return, however, to Prof. Tacchini's other observations. He found that the prominences which were visible both during totality and by the ordinary method presented very different appearances, so that we are driven to the conclusion that by the latter we only see part of the phenomena. This entirely accords with Mr. Lockyer's recently published views, in which it is suggested that the metallic prominences seen near spots are really mixed up and down rushes, with probably an excess of the cooler descending material. Thus, for instance, the metallic prominences observed by the ordinary method after the eclipse were found to be only the central portions of those observed during totality, the part visible only during totality forming a whitish fringe round the more incandescent center. Another very important observation was made. The "flash" of bright lines, attributed by Prof. Young to the existence of a thin stratum which was supposed to contain all the vapors the absorption of which is registered by the Fraunhofer lines, was found to be due solely to the great reduction in the intensity of the light reflected by the earth's atmosphere allowing the spectrum of the higher regions to be seen the moment the lowest stratum of the corona was covered by the moon. This is carrying the unveiling of the spectral effects by the increasing darkness recorded in the Egyptian eclipse to its furthest limit, and it harmonizes all the observations of this kind made since the eclipse of 1870.

About twenty photographs of the corona have been obtained in all, and five photographs of the chromosphere and lower regions of the corona. Mr. Maunder obtained seven of the corona, and could have obtained more, at Carriacou. Captain Darwin obtained six, and Dr. Schuster, we believe, five, at Prickly Point. Of the photographs, seven spectra, two with the solar spectrum on the same plate—the only ones worth anything—have also been secured by Mr. Maunder.

Among the records obtained on this occasion must be classed the disk observations, now for the first time included in the ordinary routine of eclipse work. The point of a disk observation is that an observer is by its aid able to observe the outlying solar appendages under the best conditions, so far as the sensitiveness of the eye is concerned. For ten minutes before totality the observer is blindfolded, and at the moment of totality he is led to a small aperture through which, the bandage over his eyes having been removed, he sees a black disk some forty feet away, which shuts off the moon and the brighter interior portion of the solar atmosphere. The eye, therefore, being thus shielded, is in the best position to pick up faint streamers extending beyond the borders of the disk, and to note their positions and extension.

Streamers were thus noted at Grenada, extending far beyond the limits seen in the ordinary way, but the air was so saturated with aqueous vapor and incipient cloud, even where substantial clouds did not make their appearance, that the failure of any of the observers to see the equatorial extension observed by Prof. Newcomb in the clear sky of Wyoming, at an elevation of 7,000 feet, in 1878, by no means proves that the extension was not there. The question of the continual existence of an extension of matter of some sort or other in the plane of the sun's equator must be held to be still *sub judice*.

### Damaskeening.

The figuration presented by the surface of steel and iron guns, small arms, etc., and also the plain brown or black surface of modern steel guns, is known as "damaskeening," and is produced by treatment with weak acids, which act unequally upon the different parts of the metal under treatment, the harder portions of the metal becoming covered with a thicker film of carbon than the softer portions. The color of these thin films varies from light brown to black, according to the more or less prolonged treatment with the acids. If the figuration is not sufficiently elaborate, owing to the metal not having sufficient fiber, and to the fiber being too straight and regular to produce the desired effect, it is customary for the makers of fowling pieces and other light goods to paint or stencil a pattern on the surface of the metal with the acid, and in this way the figuration can be made as effective as desired. The solutions largely used at many works are as follows:

For steel, sulphur 1 oz., tincture of steel 1 oz., nitric acid 1 oz., sulphuric acid ¼ oz., mercuric chloride ½ oz., copper sulphate ½ oz., spirit of niter 1 oz., water 1 qt.; for iron, tincture of steel ½ oz., nitric acid 1¼ dr., mercuric chloride 1 dr., copper sulphate ½ dr., spirits of wine 6 dr., water 8 oz. The solution used at Woolwich and Elswick for steel guns, etc., is as follows: Tincture of steel 2 oz., nitric acid 1 oz., copper sulphate 1 oz., spirit of niter 1½ oz., spirits of wine 1½ oz., water 1 gal. This is a much better solution, and works remarkably well; it is smeared over the parts, and when dry another coat is put on. This will produce a brown color; but if it is not dark enough, the operation must be repeated until the desired tint is obtained. Six coats are sufficient to make the surface black. The acid is then killed by washing with soda solution, and the surface rubbed with a hard brush or "file card" until smooth, after which it is rubbed with oily waste. For iron there is nothing better than mercuric chloride or antimony chloride, dissolved in water, with a little spirit of wine added to help it to dry. The action of these reagents will be readily understood by those acquainted with elementary chemistry, and it is therefore unnecessary to describe them. All the weights given are avoirdupois.

### Water Power in Cities.

Some idea of the large amount of water required to drive even a small motor may be gained from the following by James Emerson, in the *American Engineer*:

Ordinarily, 60 gallons in each 24 hours is the allotment per each inhabitant for cities. Some one has estimated the average under which the water of cities is distributed to be 60 feet, undoubtedly an overestimate, for though in exceptional cases there are places where the head is from one to two hundred feet, it is far more often the case that the upper rooms of hotels and residences in cities cannot be supplied from the pipes, and particularly so since the erection of the lofty structures now so common. But as a working point, suppose the average to be 60 feet; 0·1469 cubic foot of water per second, or about 66 gallons per minute, falling 60 feet, equal one horse power, or six gallons more than the allowance for an individual for 24 hours, is required each minute to produce one horse power, or, if used ten hours per day, the supply for six hundred inhabitants.

For an actual horse power necessary to drive a printing press or other machine a quantity of water sufficient to supply from twelve to twenty-five hundred persons will be required, that is, if the said machine is driven ten hours per day. Can cities afford to furnish such a supply, and more particularly so where the water is pumped? For, for every horse power distributed to various parts of a city through small pipes, valves, and abrupt turns, at least two horse power are expended at the pumping station. There are other obstacles that cannot be overcome. Where the water is taken from a lake, as it is at Chicago and Milwaukee, the city authorities have control, but in most cases the supply is taken from rivers, ponds, or lakes owned by manufacturing companies, and though such water may be taken for domestic purposes, not one drop would be allowed to be rented for power.

There are exceptional cases where cities acquire the entire supply in anticipation of increased population, and for the time being there is a surplus that may be used for power instead of running to waste. In such cases a simple turbine or impact wheel will be found by far the most economical in first cost and use of water. It will be desirable, however, to place them where their humming will not become unpleasant.

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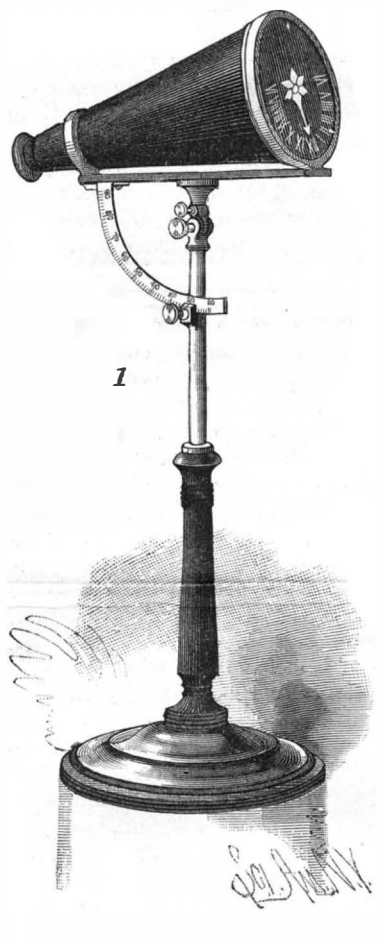
## POLARIZED LIGHT.

### PRACTICAL APPLICATIONS OF THE POLARISCOPE.

BY GEO. M. HOPKINS.

VI.

The practical applications of the polariscope are few but important. In chemistry, its most prominent use is in the determination of sugars. In medicine, it finds an application in the examination of diabetic urine. In geology and mineralogy, it is of utility in determining the origin and nature of rocks and minerals. In photometry, it forms the basis of several photometers. In photography, the polariscope, or at least a part of it—the Nicol prism—has been employed for reducing the glare of highly illuminated objects. In a similar way, the Nicol prism has been used for extending the field of vision in a fog. It forms an important part of the water telescope. It has also been used to some advantage in viewing paintings unfavorably situated in galleries. In the trades, the polariscope has proved useful in detecting strains in glass. By opticians, it has for years been recognized as a test for the genuineness of Brazilian pebble lenses for spectacles. It has also proved of great utility to the microscopist in the microscopic examination of structures.




WHEATSTONE'S POLAR CLOCK.

One of the most curious uses of polarized light is the indication of the time of day. Sir Charles Wheatstone devised a polar clock in which a Nicol prism in connection with atmospheric polarization is made to indicate the time of day. Several forms of this instrument have been made; one of them is shown in Figs. 1 and 2.* Atmospheric polarization, according to Professor Tyndall, is due to the reflection of light from the fine particles of matter floating in the air. By examining the sky on a clear day by means of a Nicol prism and a plate of selenite or other crystal, polarization will be detected without difficulty. The brightest effects are noticed at a point 90° from the sun. By directing a Nicol prism to the north pole of the heavens—a position always at right angles to the sun, or approximately so—and turning it round, the colors of the crystal plate, viewed through the prism, will change in a definite order, or, if the position of the Nicol be fixed, the movement of the sun will produce similar changes of color. The polar clock is based upon this principle.

The inventor describes this instrument as follows: "At the extremity of a vertical pillar is fixed, within a brass ring, a glass disk, so inclined that its plane is perpendicular to the polar axis of the earth. On the lower half of this disk is a graduated semicircle, divided into twelve parts (each of which is again subdivided into five or ten parts), and against the divisions the hours of the day are marked, commencing and terminating with VI. Within the fixed brass ring containing the glass dial plate, the broad end of a conical tube is so fitted that it freely moves round its own axis; this broad end is closed by another glass disk, in the center of which is a small star or other figure, formed of thin films of selenite, exhibiting, when examined with polarized light, strongly contrasted colors; and a hand is painted in such a position as to be a prolongation of one of the principal sections of the crystalline films. At the smaller end of the conical tube a Nicol prism is fixed so that either of its diagonals shall be 45° from the principal section of the selenite films. The instrument being so fixed that the axis of the conical tube shall coincide with the polar axis of the earth, and the eye of the observer being placed to the Nicol prism, it will be remarked that the selenite star will in general be richly colored; but as the tube is turned on its axis the colors will vary in intensity, and in two positions will entirely disappear. In one of these positions, a smaller circular disk in the center of the star will be a certain color (red for instance), while in the other position it will exhibit the complementary color. This effect is obtained by placing the principal section of the small central disk 22½° from that of the other films of selenite which form the star. The rule to ascertain the time by this instrument is as follows: The tube must be turned round by the hand of the observer until the colored star entirely disappears, while the disk in the center remains red; the hand will then point accurately to the hour.

"The accuracy with which the solar time may be indicated by this means will depend on the exactness with which the plane of polarization can be determined. One degree of change in the plane corresponds with four minutes of solar time."

In Fig. 3 is shown the tourmalin tongs, the simplest polariscope known. It consists of two plates of tourmalin, cut parallel to the optic axis of the crystal, and mounted in cells arranged to turn in eyes formed at the extremities of the looped wire. When the plates are parallel, light passes through them; but when they are arranged at right angles with each other, the light is completely extinguished. If a plate of crystal, a Brazilian pebble spectacle lens for example, be placed between the tourmalins arranged in this way, the light will again pass, showing that it has been depolarized by the rock crystal.

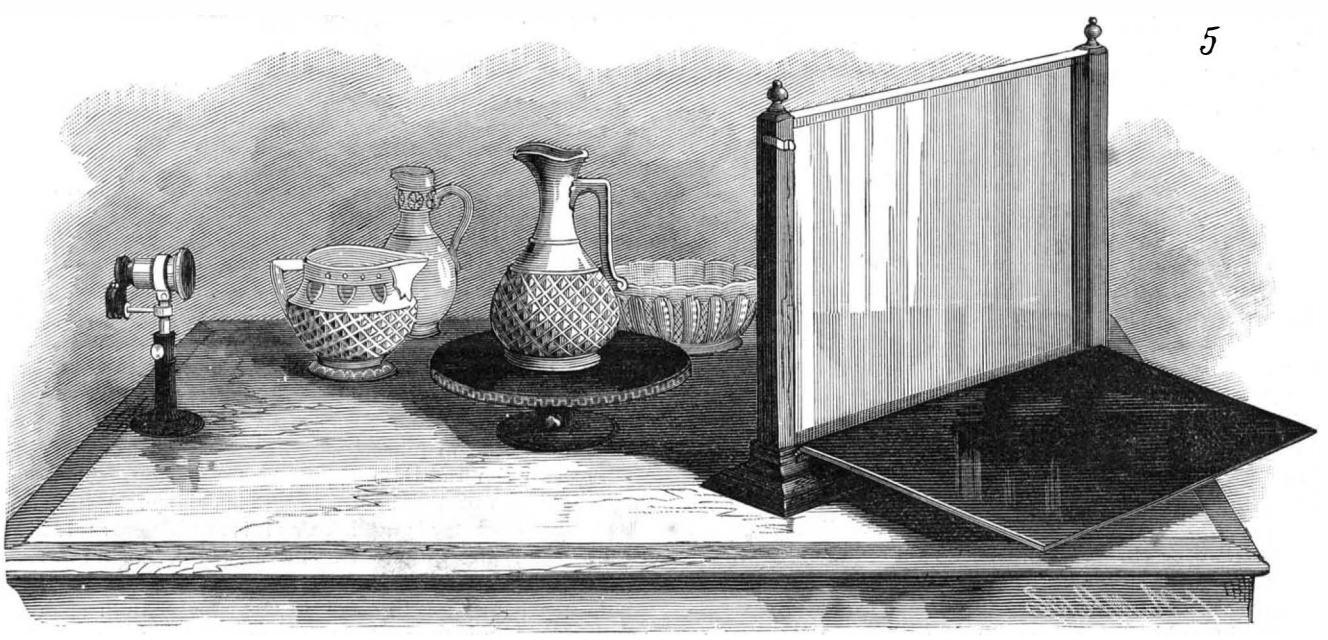
This has been accepted as an infallible test of the genuineness of lenses of this class. In the hands of an expert it is undoubtedly valuable, but glass lenses may be put under strain by heating them and allowing them to cool rather quickly. They will then, to some degree, act on the polarized beam like the true crystal.

This form of polariscope is useful in the examination of crystals generally, but on account of the natural dark color of the tourmalin, the utility of the instrument is limited.

In Fig. 5 is shown a polariscope designed for the examination of large objects, such as glassware, etc. It consists of a bundle of 16 glass plates, about 20 or 24 in. square, arranged with reference to the Nicol prism employed as an analyzer at an angle of 35° 25′. Behind the series of plates is hinged a board covered with black velvet, which may be raised up parallel with the glass plates when it is desired to polarize the beam by reflection.

The analyzer, a Nicol prism, is mounted in a revoluble tube, supported by the small adjustable standard. Articles to be examined are placed on the small table between the polarizer and analyzer.

The light for the polariscope should be taken through either a white paper or cloth screen or a plate of ground glass. Any strain in the article examined will exhibit itself by its depolarizing effect on the polarized beam.



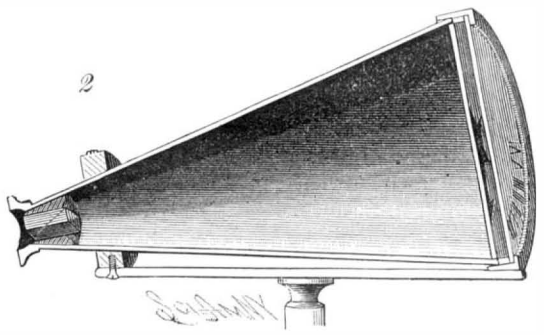

POLARISCOPE FOR LARGE OBJECTS.

* Other forms are described in Spottiswoode's "Polarization of Light."

THE forests of Ohio occupy about seventeen per cent of the entire area of the State.

### The Coal Stealing Industry.

"Anthracite coal will not melt, evaporate, or blow away while in transit over a railroad," said an officer of one of the great coal-carrying companies at Scranton, the other day. "But there never was a train loaded with coal yet that reached its destination with the weight of coal it started with by a good many tons. Every station along a coal-carrying road has its complement of coal thieves. Many of them were formerly engaged in the business of selling coal to others, the stocking of their yards being the result of coal pilfered from the company. This peculiar style of dealing in coal, it has been learned, was carried on systematically in some places for years.

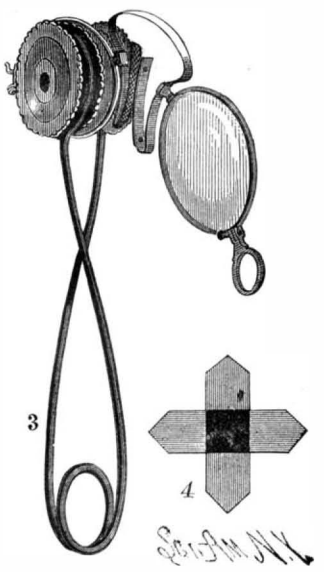



LONGITUDINAL SECTION OF POLAR CLOCK.

"But in spite of the vigilance of our detectives, the extent of the operations of thieves along the coal-carrying railroads is still something enormous. The thieves are so shrewd and so systematic in all their operations that they can relieve a train of many tons of its cargo in the course of a few minutes.

"At one station alone on the Erie road, not less than thirty tons of coal are taken from the cars every day, or rather every night, as the operations are carried on only on night trains.

"Trainmen have their customers along the line, and as the trains pass by certain places agreed upon, a few lumps are tossed off daily, and many a ton of coal is thus disposed of from every train."




TOURMALIN TONGS.

### Disposal of Hotel Sewage.

An esteemed correspondent who has recently passed some time at the Manhattan Beach Hotel, at Manhattan Beach, L. I., writes that the system of sewage disposal in operation there is very successful. He does not think any system could work any more satisfactorily than does this one, designed by Mr. J. J. Powers, a Brooklyn plumber. He says:

"The sewage (excreta and house water exclusively) flows by pipes (of such moderate size as to insure a speedy flow) into wooden water-tight tanks, where, by the use of such cheap material as charcoal and copperas, the whole mass, ninety per cent of which is water, is economically and thoroughly disinfected and deodorized, the solids being precipitated, while the liquids flow in a clear and harmless stream to the sea. The process works automatically and easily; there is no smell, even close to the settling tanks, and few of the hundreds of thousands who visit those wonderful caravansaries have any comprehension of how largely the welfare and business of the whole island depends upon this common sense invention of one clear-headed, fair-minded sanitarian. The solid portions of the sewage are disinfected and drained, and are removed as frequently as is necessary; the product (called native guano), a dark-colored poudrette, is used upon the lawns, and with magical effect, and when sold brings $20 a ton."—*Sanitary News.*

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## THE QUADRUMANA.

L. P. GRATACAP.

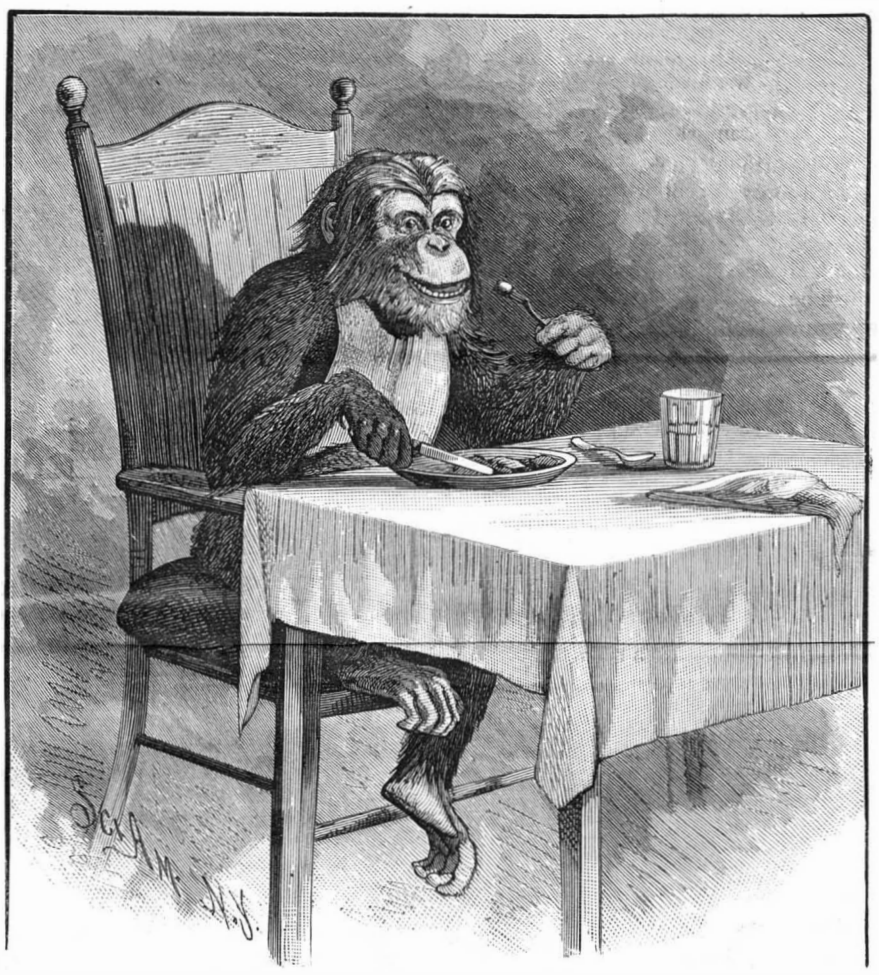
No group of animals has from the earliest days attracted more curious attention than the monkeys. Their grotesque mimicry of man, their innate proclivities to mischief, their unconscious humor, their agility, have drawn to them the interest of the populace, while their structural affinities and their enigmatical relations to the human race have evoked from science a patient study, which, as directed by different motives, leaves the quadrumana today "a vexed question" in the discussion of animal evolution.

The old Egyptians placed their images in their elaborate pantheon, the mystical Hindoos built dwellings for them, the Romans taught themselves anatomy by their dissection, the Arabs looked upon them as the progeny of Satan, the ancient dwellers in Mexico wrought their figures in frieze and ornament, and to-day sightseers linger longest where, in our menageries, they gambol and chatter; while over their problematic claim to be considered man's lineal ancestors the savants and doctors fight unweariedly. Perhaps the first mention of these interesting creatures we have found among the ancients, and the one most familiar, is in the chronicle of Hanno, the Carthaginian voyager, who visited, over 2,000 years ago, the west coast of Africa. He speaks of finding the "*goutlai*" on an island, whom he and his men chased, but could not overtake, and at last only secured three females, who bit and scratched their captors so vigorously that they had to be slain, and their skins were afterward kept in the temple of Juno at Carthage. Hanno speaks of these strange inhabitants as wild men, with hairy women, and he doubtless met a colony or pack of anthropoid apes.

Pliny writes: "On the Indian Mountains to the south, in the land of the Catharcludi, there are satyrs. These are the swiftest of creatures, sometimes going on all fours, sometimes upright like men, and they are so active that they can only be captured when old or sick."

In the past geological stages of the earth's history, monkeys were much more widely distributed than today, and among the forests of France and England they flourished in nimble groups, where now only careful protection insures their immunity from decline and death. The quadrumana belong to the warm regions of the globe. They live chiefly within the tropical limits, though reaching northward from Africa into Europe at Gibraltar, where a Uracaque has effected a settlement among its rocks and ledges; and again another species in Asia has extended its habitat to Japan, while as an extra limital example they reach in South America to Paraguay. They are all included, without exception, between 37° north and 35° south latitude. They exhibit the greatest fortitude under colder conditions upon the mountain sides of their natural domains, and are occasionally met at elevations which are surprising.

A species does not cover a wide geographical area, but is distinctly limited. The orang-outang is found in Borneo and Eastern Sumatra; the chimpanzee and the gorilla on the west coast of Africa; the tailless gibbons upon the Bay of Bengal, in Sumatra, Java. Among the Semnopitheci, as Sir Emerson Tennent says (quoted by Murray), "each separate species has appropriated to itself a different district of the wooded country, and seldom encroaches on the domain of its neighbors," being found in Ceylon, India,



MR. CROWLEY, OF CENTRAL PARK MENAGERIE, N. Y.

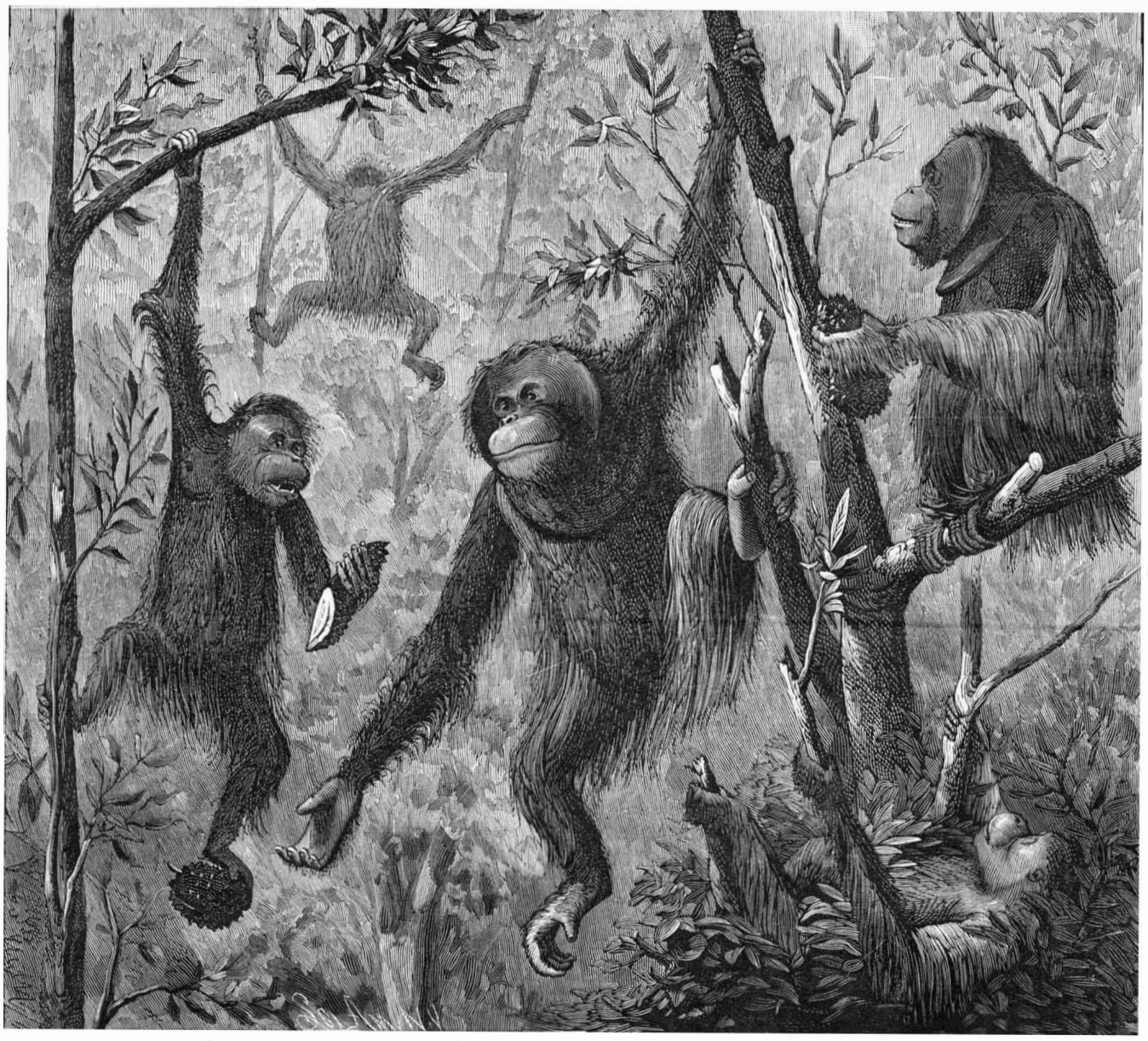
etc. The baboons and mandrills are generally peculiar to Africa, though aberrant forms are found upon the Philippine Islands. The New World monkeys are confined almost altogether to South America, though some species penetrate the northern continent as far as Tampico, and naturalists are yet expectant that in unexplored recesses of Central America new species may be discovered. The New World monkeys spread over a wider territory and furnish the greatest number of mammalian species within their region, the mammalian fauna of South America being singularly meager and homogeneous.

The natural home of the monkey is among the trees. Here he leaps with a buoyant delight that defies description or portraiture, swinging, hanging, with innumerable gesticulations and grimaces he passes from bough to bough, and will traverse long distances in this way with a grace and ease that has been the admiration of writers and artists, whereas, when put upon a level ground, his slow, aimless, and ungainly movements only excite ridicule and disgust.

The technical definition of the quadrumana, or the four-handed (*quatuor* four, *manus* hand) animals, is easily understood and remembered. They form the thirteenth order of mammals, are comprised with man among the primates, and are distinguished by having the innermost toe of the hind limb separated from the other toes, and is opposable to them, so that the hind feet become prehensile hands, the innermost toe of the fore limbs (thumb), if present, also usually opposable to the other digits. The incisors are four in each jaw, two right and left, and the molars similarly four. The divisions of this order are very natural, and, as pointed out or defined by Owen, are: 1st. The Strepsorhina or twisted nostril group, including the true lemurs, centering in Madagascar. 2d. The Platyrhina, or group with nostrils placed far apart, thumb of fore feet, if present, not opposable to other digits, embracing solely the South American monkeys. 3d. The Catarrhina, with nostriis oblique, close together, thumbs all opposable; the highest section, among which are placed the anthropoid apes, without tails; while in other members of this section this member has lost the prehensility which among the Strepsorhines and Platyrhines makes it the most efficient instrument for locomotion.

It would be of interest to review even briefly some of the characters of the attractive lemurs, whose haunts are in the fruit-laden forests of Madagascar, where in the deepest seclusion they form their bands and move with gliding and noiseless activity among the highest branches; or describe some of the singular spider monkeys, howling monkeys, capuchins, and squirrel monkeys of South America. But we must attempt to explain the state of that interesting question asked so commonly, Have *we* come from monkeys? and then acquaint the reader with some facts about the chimpanzee and the orang-outang, whose admirable portraits accompany this notice. To make even these points intelligible may exceed our limits.

The question of the origin of the human race has attracted attention for ages, and naturally it was long ago suggested that some connection between men and monkeys might be discovered leading to more distinct ideas on this subject. Darwin epitomized the views of earlier investigators, and added many new lines of fertile study and suggestion. Structurally, men and the quadrumana belong to the same order—the primates; and it is insisted that this



THE ANTHROPOID APE AT HOME.

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structural resemblance predicates a similar structural origin or some common progenitor. The popular misapprehension that writers holding this view suppose that man is a lineal offshoot or child, through intermediate links, of our anthropoid apes is quite unjust to science. Our physical frame is most heterogeneously, so to speak, allied to the entire monkey race. We can claim, anatomically, no direct descent from any known species. As Urwart says:

"Some of the lower apes resemble man more than they do the anthropoid ones in the length of the arm and hand compared with that of the spine; while in the length of the leg without the foot, compared with that of the arm without the hand, he is equaled only by certain lemurs. The baboons (the lowest of the anthropoids) exceed all the higher apes in resemblance to man in the sigmoid curvature of the spine," and in many other particulars, unnecessary to mention here. Some, indeed, of the New World monkeys approach man in some respects nearer than the Old, and again and again it has been shown that the child monkey is nearer the child man than the adult monkey is to the adult man—a significant divergence through age. In fact, the aggregate features of the human frame, when compared with their closest correspondences among the quadrumana, establish between man and these a network of intercrossed relationships.

Hence the proposition is, that man has issued from the group of the quadrumana genealogically at some far distant period, and descended from a creature whose physical construction had begun a variation which resulted in a line of descent of which man, as at present made, represented the climax. At the same time the close likeness of the anthropoid apes to man is very obvious, and some recent cases of hairy and tailed men might be regarded as *reversions* to a simian ancestry. However, the proposition cannot be, or has not been, absolutely proved. It rests upon an inherent probability based upon a study of evolution in other branches of animal life, and is bound up logically in what has been called the *monistic* view of creation, viz., that a single impulse at a moment of time, however it may be regarded, has started a vital growth in nature, which, progressing and widening under the control of fixed laws, peopled the world with all its past and present inhabitants without invoking at any moment, in the long train of sequences thus inaugurated, any special act of creation. Naturally, man is but one, though the highest, of the occupants of this globe, and is subjected to the same law of origin.

Was war ein Gott der nur von aussen stiesse
Im Kreis das All am Finger laufen liesse,
Ihm ziemt's die Welt im Innern zu bewegen,
Natur in Sich, Sich in Natur zu hegen,
So dass was in Ihm lebt und webt und ist,
Nie Seine Kraft, nie Sein Geist vermisst.—*Goethe.*

So far as regards man's physical characters, his psychic part is less easily to be imagined as derivative from the brutal and sensual disposition of the quadrumana. As Hartmann says:

"A great chasm between man and anthropoids is constituted, as I believe, by the fact that the human race is capable of education, and is able to acquire the highest mental culture, while the most intelligent anthropoid can only receive a certain mechanical training."

The anthropoid apes are the gibbons, gorilla, orang-outang, and chimpanzee. The orang-outangs, of which an admirable group, mounted by Mr. Hornaday, the hunter and writer, is now in the American Museum of Natural History, and is shown in our artist's vivid drawing, inhabit the islands of Sumatra and Borneo. They live in the dense forests in the low, swampy districts, traveling with considerable speed through the summits of the trees, and avoiding the drier hill country. Their name simply means *woodman*, indicative of their habits. They are hunted by the natives and sold to the Chinese. They inhabit the topmost parts of the trees, making rude and shallow cradles of leaves and twigs, in which they sleep, rising from their beds at 9 A.M. and retiring at 5 P.M. Except at night, they seldom descend to the ground. Their gait is awkward, and they display none of the agility of the chimpanzee or gibbon. Their long arms are possessed of great strength, and amid the durion trees, whose fruit they love, they can be seen performing feats requiring great muscular strength. As many as four species have been enumerated by some writers, and only one by others. Those figured in our illustration are not commonly, or not at all, seen in books. The fleshy disk in the male is a striking feature, and would seem to justify a specific distinction. They are slow, inert, and generally timid, but in close quarters, or thoroughly aroused, fight with ferocity.

The chimpanzee inhabits the west tropical coast of Africa, and is a species made familiar to our public by the general favorite, Crowley, under care of Mr. Conklin, at the Central Park Menagerie. This interesting fellow has divided with Jumbo the favors of popularity, and certainly with his antics and devices affords capital amusement to the sightseers who throng about his cage.

The disposition of the chimpanzee under captivity varies greatly, some being recorded as gentle and uniformly amiable, others uncertain, capricious, and violent. Mr. Crowley's expression of face is very rueful at times, and changes from a laughable state of lugubrious contemplation to one of whimsical curiosity in the appendages and property of his visitors. With his keeper, Mr. Cooke, he seems generally mild and loving, but his malice breaks out occasionally against some teasing spectator, and he bounds and rages with impotent struggles, suggesting very unpleasant consequences if the offenders were within his reach. He has been taught to use a spoon, and sits in a most comic manner at a table with a gravity and absurd aspect of comfortable retirement that is irresistible.

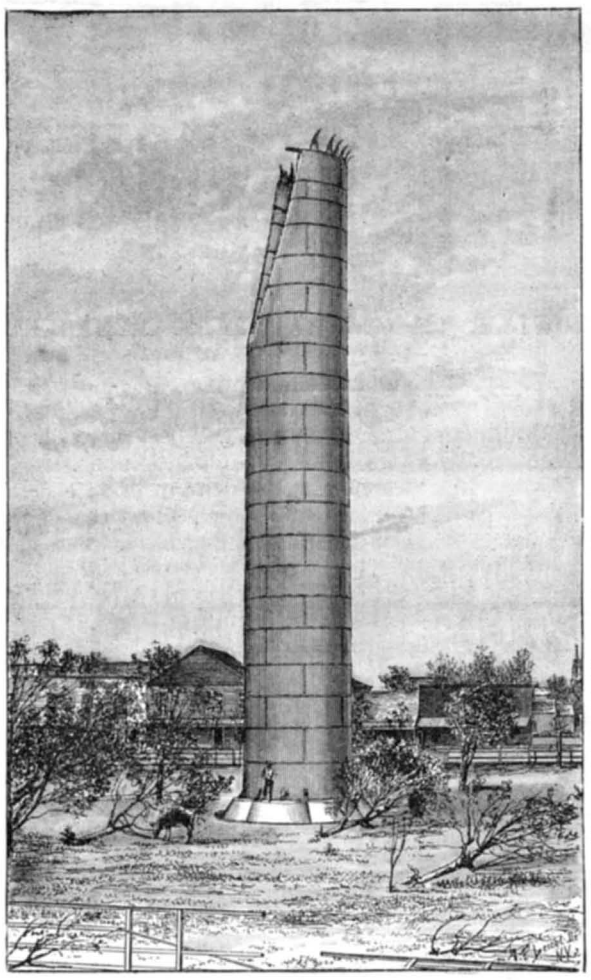
The gorilla has been successfully kept in captivity in Berlin at the Aquarium, and gained an excellent name for friendliness and docility. A famous specimen kept there died of galloping consumption in 1877. The chimpanzee Urafuca was also an inmate of the Berlin Aquarium, and was greatly prized for her gentleness and general amiability. Of her death, Hartmann writes:

"She put her arms round Schopf's neck when he came to visit her, looked at him placidly, kissed him three times, stretched out her hand to him, and died."

The real pathos of this incident, more than a hundred tales about monkey cleverness, would reconcile us to acknowledging a relationship with these remarkable creatures.

## THE WATER TOWER AT VICTORIA, TEXAS.

We are indebted to Mr. R. W. Stayton, of Victoria, Texas, for photographs of the water tower at that



THE WATER TOWER AT VICTORIA, TEXAS.

place, together with the following interesting particulars of its partial collapse:

"On the 20th of August this place was visited by a very severe cyclone, the wind reaching the velocity of about 80 miles per hour. We have a system of waterworks with a reservoir or standpipe 16 feet in diameter and 100 feet in height; the iron is one-half inch thick for the first 70 feet and three-sixteenths inch the remaining 30 feet. This pipe was erected with all the care and skill used in the construction of a steam boiler. During the storm this pipe was swayed to and fro, and the sides swerved in and out like some huge animal striving for breath, and finally collapsed as you see it in accompanying picture. The question among some of us is whether this collapse was induced or caused by the vibration or by the creation of a partial vacuum from the violent wind passing over the top exhausting the air within, having nothing within to withstand the outer pressure, there being only 70 feet of water in the pipe at the time. I claim that the collapse was caused by the wind creating a partial vacuum, and others claim that it was caused by vibration alone. The upper edge of pipe, just where the points of iron are riveted on, is re-enforced by a heavy angle iron. I send you three different views of the standpipe."

In reply to our correspondent, we would say: The collapse of the standpipe seems to have been on the side from which the greatest pressure of wind occurred, as by inspection of the photograph the trees near the standpipe, which were probably overthrown at the same time as the collapse, all lie in one direction, and that coincident with the direction of compression in the standpipe. From our inspection, the tornado was not central over the standpipe, but far enough on one side to give it the full force of its gyration. This in our opinion precludes the possibility of a vacuum being the cause of the collapse.

The thinness of the iron, three-sixteenths inch, and its great proportional area exposed to the force of the wind, will no doubt readily account for its swaying, buckling, and final collapse, if we only take into consideration the force of the wind in pounds per square foot of exposed area.

Tornado winds blow at a rate of from 90 to 100 miles per hour, and exert a force of from 40 to 60 pounds per square foot of area.

The mean area exposed above the water line, all of only three-sixteenths inch iron, may safely be taken at 300 square feet, which at 40 pounds per foot would amount to 12,000 pounds, or 6 net tons pressure on the windward side, with no support on the inside; while the leeward side was supported in tension by the small partial vacuum of a lee wind, which is equal to the slight vacuum or draught caused by blowing across an orifice, as the other parties claim. We are confident that lateral pressure caused the collapse of the standpipe.

## DECISION RELATING TO PATENTS.

**U. S. Circuit Court.—District of Connecticut.**

CELLULOID MANUFACTURING COMPANY *v.* COMSTOCK & CHENEY COMPANY.

HYATT PATENT—CELLULOID COVERING FOR PIANO KEYS.

Shipman, J.

It has always been the law that a patentable invention, although new and useful, must be the result of something more than and different from mechanical skill.

The existence of novelty and utility in a patented thing has been potent in the determination of the question of its patentability. (*McCormick v. Seymour*, 2 Blatchf., 240; *Furbush v. Cook*, 2 Fisher, 288; *Middleton Tool Co. v. Judd*, 3 Fisher, 141.)

The decision in *Hollister v. Benedict & Burnham Manufacturing Company* (113 U. S., 59; S. C., 5 Sup. Ct. Rep., 717) makes independent evidence of the existence of inventive skill, apart from inferences of such existence which may be drawn from novelty and utility, to be of greater importance than has been understood heretofore.

There was the creative faculty of invention in the abandonment of the ineffectual and mechanical attempt to make single celluloid keys in imitation of ivory single keys, and in the conception of the idea of covering a whole keyboard with a single celluloid sheet.

The patent in suit having been declared void for want of novelty by another court (*Celluloid Manufacturing Company v. Tower*, 26 Fed. Rep., 451), from which decision a notice of appeal to the Supreme Court had been given, a stay of the accounting was asked in this case; but as the facts in this case had features not brought out in the other case, *held* that there was no adequate reason for a stay of the accounting.

Motion for rehearing denied.

## A Sweet Posy.

Take two moss rosebuds, half open, a spray of rosemary, and half a dozen of the flower heads of lavender, to which add a cluster or two of mignonette, three old clove carnations, a small bunch of white jasmine, and a few leaves of the sweet scented verbena (*Aloysia citriodora*). If to the above you add a half opened old Provence or cabbage rose, so much the better; and the result will be a sweet posy that a duchess might like to have near her, and which, if tastefully put together, will delight the eyes as well as the nose. This sort of sweet posy was far more common in the days of our great-grandmothers than now. You will notice how careful the late R. Caldecott was to give his sweetest of early eighteenth century maids a dainty little posy to sniff at as they cross their tiny feet and sit demurely in the fine old Chippendale chairs he must have liked, or he would not have drawn them so well.

Well made *pot pourri* is delicious in winter, but during summer time every room in every house which has a garden ought to be full of fresh flower fragrance, leaving the mummied odors for the winter of our discontent. You must not for a moment fancy that the above recipe for a sweet posy is a bit of literary labor out of my own head, so to say. The truth is, I found it written inside the cover of an old herbal, and to-day I tested its efficiency, and having found it not wanting, I offer it to every Lady Corisande who reads the *Garden.*

THE capital stock of the American Bell Telephone Company is ten millions of dollars; and the capital stock of the various sub or license companies is fifty-four millions of dollars, or in all sixty-four millions of dollars. The Bell stock sells in market at nearly double its face value. The aggregate of the license companies' stock sells for about one-half its face value.

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## TORRICELLI'S PRINCIPLE AND MERCURY FOUNTAIN.

T. O'CONOR SLOANE, PH.D.

In a preceding article of this series, a variation on a well known experiment was described, in which a plate of glass was held against the mouth of an inverted tumbler full of water by atmospheric pressure. Those of our readers who tried the experiment probably found that the plate of glass was in very unstable equilibrium. It trembles as it holds its position, ready to fall on a slight impulse. By creating a partial vacuum within the glass, by means of a column of water, the plate will adhere strongly to it.

A piece of glass or a perfectly flat piece of thin board will answer for the purpose. A hole is perforated so as to pass through the center, and a short glass tube is fitted therein. If a glass plate is used, the hole can be drilled with a broken file and spirits of turpentine in a lathe or rapidly rotating bit stock. A piece of rubber tubing is slipped over the end of the tube as it projects from the plate. A wineglass or tumbler with a very true edge and a bowl or receptacle for water complete the requirements. The glass is first filled as full as possible of water. By immersion in the bowl, the glass and rubber tubes are also filled, and the lower end of the rubber tubing is pinched or corked so as to close it. The plate is now placed over the mouth of the glass, the tube is released or uncorked, care being taken to keep its open end under water while and after opening it. On raising the glass above the water and inverting it, the plate, when it is a couple of feet above the water bowl, will be found to adhere with considerable tenacity. If the tubing is long enough, it may be raised to any height, and will adhere the harder the higher it is raised. The column of water establishes a partial exhaustion or suction. Its weight is not supported by the glass, but by the air. The glass supports a portion of the weight of the atmospheric column. The air, pressing upwards against the plate, holds it in position.

A very good way to conduct this experiment is to do it over a wash basin. The wineglass and tubing may all be immersed together, the plate put over the mouth of the glass while all are under water, and the glass then may be lifted up and held over the water without fear of the plate falling off.

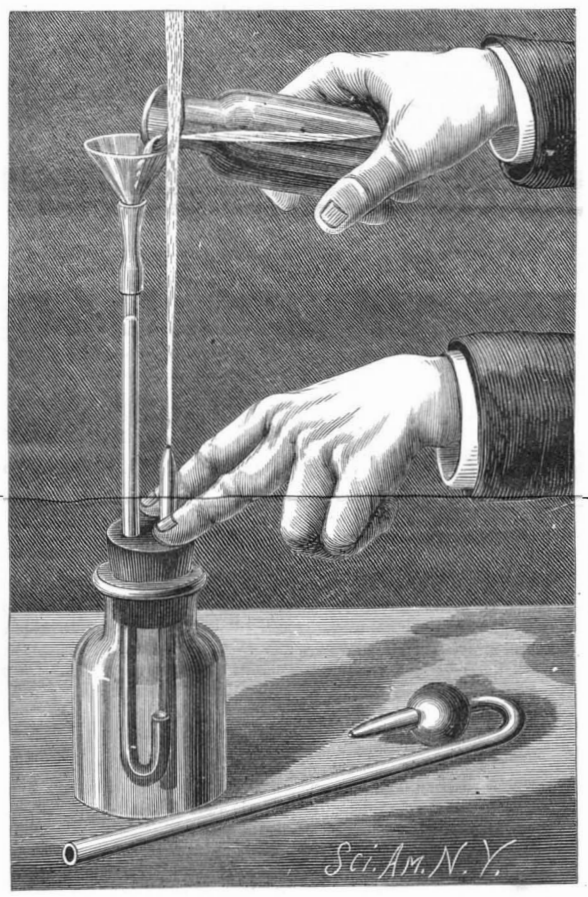
The pressure on the plate is a function of the area of the glass and of the relative height of the water column used as a measurer of atmospheric pressure. The experiment is interesting, as proving that water will not always escape from an opening. If a second hole were made in the plate, air would bubble in, but no water would run out. For this reason hose that is used for the suction pipe of pumps is stiffened by a metal helix, or coiled rod or wire, within it, so as to be incapable of collapsing.

From early times, the principle of suction, so called, has been applied to pumps. It was found that water would only rise about thirty-three feet above its level under the effects of suction. As soon as Pascal and Torricelli had reasoned out the existence of weight in the atmosphere as the cause of water rising in an exhausted tube, the corollary that a column of mercury could only rise to one-thirteenth of this height necessarily followed. A column of mercury one inch in height will produce the same pressure per square inch that a column of water thirteen inches high develops. Availing ourselves of this principle, a comparatively low column of mercury may be made to produce quite a strong hydraulic pressure, and will drive a jet of water far above its own level.

A simple apparatus for this experiment may be made from a bottle, a funnel, and some tubing. A straight piece of glass tubing is drawn out in an alcohol lamp or Bunsen gas burner to a fine straight jet. Another piece has one end bent around and up. Both pieces are passed through apertures in a cork, as shown in the cut. A funnel is attached to the bent one, the bottle is filled with water, and the cork is tightly placed in position in the neck of the bottle. One finger is placed over the end of the jet tube, and mercury is poured into the funnel. This creates a strong pressure. The finger is removed from the tube, when a strong jet of water springs into the air, rising several feet above its source, and presenting the somewhat paradoxical effect of a fountain throwing water above the level of its reservoir. A six inch column of mercury will throw water in this way to a height of four or five feet. As the pressure is so strong, it is sometimes necessary or advisable to hold the cork down, lest it should be blown out.

A simple bent tube, with a bulb and jet, shaped as is the one seen in the foreground, may be substituted for the bottle and tubes. A more compact arrangement may be made by a glass blower. The general construction is shown in the cut. A funnel, bulb and a plain bulb are blown upon a tube which is bent into U shape between them. For jet a piece of capillary tube of the section and size indicated is employed. A small glass cock comes between the jet and the water bulb.

To use it, it is partially filled with water, until the lower bulb is full. The cock is then closed and mercury poured in until the upper bulb is full of the metal, or nearly so. Then, on turning the cock, a jet of water is thrown up, it may be nearly to the ceiling of an ordinary room. A good size for the bulbs is two inches in diameter. Strong tubing must be used




MERCURY FOUNTAIN. I.

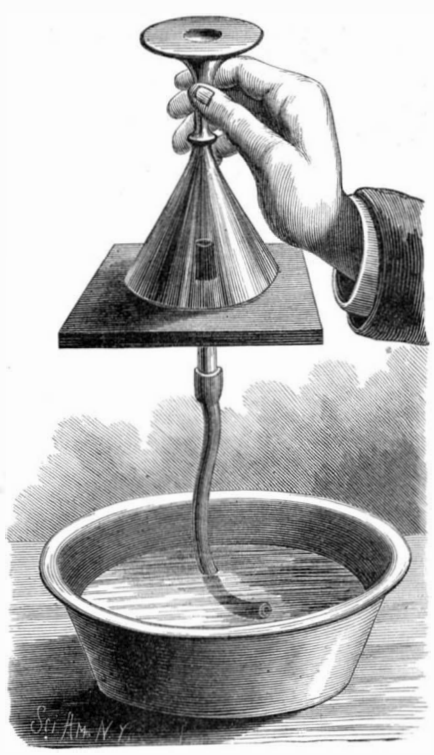
for the rest of it. A mercury column of six or eight inches in height may be allowed for.

In handling mercury, care is requisite on account of its weight. It often introduces the element of instability, where water would be safely held. If it is scattered about, it is not only annoying, but injures gold articles. Hence, in working with it, all jewelry, watch chains, or watches should be removed.

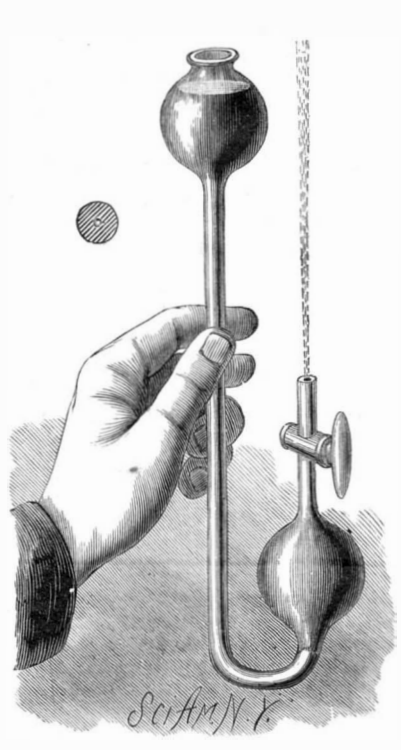
### Mileage of the Circulation.

In preparing lectures on vital or animal mechanics for a Cantor course at the Society of Arts, several practical points of new or renewed study have come before me, some of which are, I think, deserving of brief notice. One of these is the question of the mileage of the blood current of a healthy adult man, in whom the current shall be traversing the conduits of the circulation under the direction of sixty-nine strokes of the heart per minute, at the assumed propulsion of nine feet at each left ventricular pressure.

The distance traversed would, I estimate, be at the rate of two hundred and seven yards per minute, or seven miles per hour, or one hundred and sixty-eight miles per day, or sixty-one thousand three hundred and twenty miles per year. Supposing, therefore, that a man who has lived eighty-four years could have one blood corpuscle floating all that time round his circulating channels—as a planet circulates round a sun—that corpuscle would have performed at the close of the time named the grand tour of five millions one hundred and fifty thousand eight hundred and eight miles. The heat generated by friction in this motion of the blood we may take as included in the normal constant of ninety-eight and four-fifths deg. Fah. What the excess would be when, as in fever, the rate of passage may extend to over double the normal, or fourteen miles an hour, at full tension, can only at present be estimated on data which have to be formulated, and are, therefore, inexact. But here a most important field is open for inquiry, and includes the questions: 1. Is the excess of febrile heat in pyrexia due to increased pulsation at full tension? 2. Is the increased motion due to the high temperature? 3. Are both dependent on one common cause? We really know nothing about pyrexia until these questions are determined. A pigeon lives always at what in the human subject would be the highest pyrexia. Its temperature is 108° Fah.; its arterial pulsations are 140 beats per minute; and it has a surface of body presenting the fullest resistance to conduction. Does this truly pyrexial animal owe its normal high temperature to its rapid circulation? Does its high temperature give rise to its rapid circulation? Or, are the heat and motion dependent on one common undiscovered cause?—*The Asclepiad*.




TORRICELLI'S PRINCIPLE.




MERCURY FOUNTAIN. II.

### Effect of Light and Water Colors.

Mr. William Simpson records in the London *Times* the results of an experiment in which washes of color have been exposed for fifteen years, and portions of the same wash preserved from the light, so that they can now be compared. The list embraces thirty-one pigments, including the most of those generally used by water color artists. The washes were made in stripes upon cards; and the cards afterward were cut in two, so that the exposed and unexposed tints could be compared exactly where they were separated. The exposed slips were pasted on a sheet of paper, and placed in a frame, which was hung on a shutter of a window with an east light. Here they remained for fifteen years.

The following is the list of colors, with Mr. Simpson's remarks: Yellow ocher unchanged; Indian yellow has faded considerably; lemon yellow is not perceptibly affected; gamboge has faded; Newman's permanent yellow unchanged; cadmium yellow, this has not faded, but has seemingly become of a browner tinge. Chrome yellow faded considerably; the slip not exposed seems to have become more orange, but, unfortunately, I had not noted at the time which chrome had been used. Brown pink has faded, but it has stood better than might have been expected from its reputation. Emerald green scarcely changed. Burnt sienna unchanged. Vandyke brown unchanged. Sepia, this shows a very slight tendency to fade. Roman sepia, this may have faded also, but, like the common sepia, the change is not very perceptible. Burnt umber unchanged. Bister unchanged. Brown madder, this color has lost a little of its redness. Light red unchanged. Vermilion shows no change. Indian red unchanged. Crimson lake, this color has all but disappeared from the paper; at one side where the color was laid on deeper a brown streak still remains. Carmine, this, like the lake, has entirely gone, but where the carmine was laid on deeper, a faint brown streak is still left. Madder lake, this color has stood well, but it is now a little less red, and more of a purple. Purple madder, like the other madders, this has stood, but seems to be changed very slightly in tone. Cyanine blue, seemingly unchanged. Prussian blue unchanged. French blue very slightly faded. Cobalt, I can detect no change in this valuable pigment. Ultramarine is, of course, unchanged. Newman's azure is unchanged. Indigo, where there was a rather deep wash of this color the exposed slip shows now an exceedingly light tint of gray; in fact, it has nearly left the paper white, but has not vanished so completely as the crimson lake and the carmine. Lampblack unchanged.

A CIRCULAR has been issued from the Navy Department directed to all inventors of torpedoes or those interested in the subject, inviting them to communicate with Commodore Sicard, Chief of Ordnance. Seventy-five thousand dollars was appropriated at the last session of Congress for the purchase, manufacture, or testing of torpedoes, and a board of naval officers, of which Captain A. P. Cooke is president, was appointed several weeks ago to examine and test such torpedoes as may be submitted.

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## ENGINEERING INVENTIONS.

A car coupling has been patented by Messrs. John B. Stone and John Pennington, of Pewamo, Mich. Within recesses of the drawheads are U-shaped latches which have cross pieces at their outer ends, the parts being readily replaced in case repair is necessary, no springs being required, and the strain on the coupling pin being relieved by the latches.

A governor connection has been patented by Mr. Robert J. Hotchkiss, of Downsville, N. Y. Combined with the governor shaft is a toothed wheel with two or more series of teeth of different diameters, pinions for engaging the teeth, and means for imparting motion from the engine to one or the other of the pinions, in order to change the speed without changing the adjustment of the governor or increasing or diminishing the steam supply.

A car coupling has been patented by Mr. Charles R. Harris, of Philadelphia, Pa. According to this invention, the drawhead has a perpendicular opening, and there is a spring actuated coupling pin arranged to move in a horizontal line, and released to be thrown to place within the drawhead when the cars come together, the device being one which can be used with the ordinary coupling with the employment of a special form of link.

## MECHANICAL INVENTION.

A shaft coupling has been patented by Mr. Benjamin F. Applegate, of New Albany, Ind. Half clutches are fixed to the ends of the shafts to be coupled, having interlocking driving shoulders, and one half clutch having peripheral screw threads and an internally screw threaded sleeve engaging the threads of the other half clutch, with other novel features, making a clutch which will drive the coupled shafts without lost motion or back lash, and with which wear from long use may be readily taken up.

## AGRICULTURAL INVENTIONS.

A harrow has been patented by Mr. Riley Cox, of Boise City, Idaho Ter. It is formed of two sections, so arranged that the forward ends of each are practically in the center of the sulky, together in operation forming almost a solid harrow frame, so that one section will in part brace or support the other.

A fertilizer distributer has been patented by Mr. Peyton A. Lee, of Coushatta, La. It is adapted for use in connection with the running gear of an ordinary wagon, the bed being driven from the drive wheel, and a breaking roller journaled in the sides of the main frame to break or disintegrate the manure, deflectors being pivoted for adjustment to distribute or drill the fertilizer in wide or narrow rows as may be desired.

## MISCELLANEOUS INVENTIONS.

A necktie fastener has been patented by Mr. James French, of New York city. It is formed with an opening or passage for a portion of the tie, so the fastening of this portion secures the fastener in place, avoiding stitching or otherwise fastening the fastener separately.

A weatherboarding attachment for try squares has been patented by Mr. William T. Seargeant, of Marshall, Mo. It is a double legged metallic scriber, formed with a means for attachment to the stock of the square, and carrying a scribing point, making a device which is cheap, durable, and efficient.

A soap dish has been patented by Mr. George H. Laxton, of Jersey City, N. J. It is so made that it can be hung up on pegs, placed and held on the edge of a wash tub or stood upon a level surface, having corrugations and apertures in the bottom, with other novel features.

A combined button hook and corkscrew has been patented by Messrs. Louis B. Prahar and Charles S. Shepard, of Brooklyn, N. Y. The invention covers several methods of hinging a corkscrew to a button hook in a simple manner, whereby it can be conveniently carried in the pocket.

A bicycle stand has been patented by Mr. Albert W. Gump, of Dayton, O. Its construction is such that, while it may be compactly folded for transportation, it is readily adjustable to hold a bicycle in either an upright or an inverted position, or it can be conveniently set up to form a camp stool.

A rein holder has been patented by Mr. Neal McGoldrick, of Brooklyn, N. Y. It consists of two rigid jaws and two pivoted and spring actuated jaws, one opposite each of the rigid jaws, the device being also provided with a clamp by which it may be attached to any part of the vehicle.

A medicine chest has been patented by Mr. Terry J. Hutton, of Fergus Falls, Minn. The invention consists in a peculiarly partitioned and constructed chest of a flat shape, composed mainly of upper and lower chest sections hinged together and provided with various conveniences.

An infant's toilet table has been patented by Hannah Crocker, of Plainfield, N. J. The whole table is a low one, convenient for use by the nurse when having the child on her lap, and consists in a combination of attached tables of peculiar construction and provided with special conveniences.

A chaff guide for grain separators has been patented by Mr. Daniel O. Dockendorf, of Sheldon, Ia. It consists of perforated plates with hooked fingers, and other novel features, intended to carry all coarse foreign matters beyond the shoe, so that the chaff will be prevented from carrying grain with it to the stackers.

A wheel hub has been patented by Mr. Andrew W. Lane, of Janesville, Cal. It is formed of iron, in two halves, with flanges having radial ribs for receiving the inner ends of the spokes, it being adapted for hubs of wagon wheels of all kinds, and the hub and box fastening being adapted for use in all climates.

A revolving target has been patented by Mr. William H. Adams, of Fort McIntosh, Laredo, Texas. The invention consists principally of a revolving center frame constructed to receive several target frames, which may be easily detached from the frame and replaced therein.

A gravity latch has been patented by Mr. Uriah D. Mihills, of Fond du Lac, Wis. It has but few parts, and is simply made, but can be used for either a mortise or rim lock, and is reversible without disturbing the tumbler and follower, the latch and key being the only parts required to be reversed.

A chair has been patented by Mr. Daniel Smith, of Santa Rosa, Cal. The invention consists of a simple and inexpensive rocker frame, which may be applied to ordinary chairs of any size to make rockers of them, the rocking motion being given by springs, the tension of which can be readily regulated as desired.

A bill file has been patented by Mr. Joseph Gottschalk, of Baltimore, Md. This invention relates to that class of paper files in which are used movable puncturing and transfer wires, and covers novel devices by which the wires may be held apart when adjusted, with other novel features of construction.

A revolving show frame has been patented by Mr. William H. Genung, of Madison, O. It consists of a hollow post fitted to a spindle journaled on a suitable base, containing mechanism by which the spindle and post are rotated, the post carrying hinged arms and cords, on which is fastened a fabric cover to which goods may be attached.

A composition for preserving food has been patented by Mr. William Radam, of Austin, Tex. This invention relates to combustible compositions, which, when ignited, produce gases that have preservative and purifying effects, and is more especially designed for preserving fruits, vegetables, meats, and other perishable articles.

A chair has been patented by Mr. George J. Shults, of Avoca, N. Y. It has a pivoted back, composed of upper and lower sections jointed together and controlled by springs, and means whereby the lower section is made to move bodily forward in an approximately upright position, with other novel features desirable for easy chairs or rockers.

A bundle carrier for self-binding harvesters has been patented by Mr. Charles F. Morgan, of Taylor, Minn. The construction is such that when the desired number of bundles has been received upon the platform the driver can, by a foot lever, cause them to slide to the ground, the platform itself returning to a proper position to again receive bundles.

A submerged force pump has been patented by Mr. Lawrence A. Kelly, of East Oakland, Cal. It has hollow piston rods pivotally connected with a centrally pivoted oscillating hand lever, the valves rising and falling as the pistons work up and down, the water in the piston rods flowing back when the pump is not operated, so there is no liability of freezing.

A water conductor and receiver has been patented by Mr. William H. McKenzie, of Waverly, O. It is a novel construction of sheet tin, zinc, or similar substance for collecting the condensed moisture on store and other windows, and providing a holder to receive the same, being also useful to receive water running off when the windows are cleaned.

A wire fence gate has been patented by Mr. Theodor Ruediger, of Chaska, Minn. The ends of the wires being attached to a vertical bar, so that the latter can be closed up to a post, in such positions as it is desired to have a gate. This invention provides devices whereby such vertical bar can be conveniently attached to or detached from the post.

A compound for protecting walls has been patented by Mr. Frederick M. Ruschhaupt, of Milwaukee, Wis. It consists of variable proportions of resin, paraffine, or vaseline, or a semi-solid fat, linseed oil, sulphur, and gasoline or benzine, to be prepared and applied according to the porosity of the walls, to prevent their discoloration by efflorescence.

A sweat pad for horse collars has been patented by Mr. James H. Philpott, of Rising City, Neb. The design includes a leather or thin flexible top pad, with thicker stuffed side cloth sweat pads attached, so that the hames will lie close to the horse's neck, and the pad, being thin on top, will take but little from the size of the collar.

A motor has been patented by Mr. William Lay, of Omaha, Texas. This invention covers a novel form of propeller for boats, in which the paddles are mounted to turn on a crank eccentrically, so they can be projected out as they descend and dip into the water, and be withdrawn as they rise, the dip of the blades being readily regulated as desired.

A tree and post supporter has been patented by Mima Wrightsman, of Harper, Kansas. It consists of a pair of arms pivoted to each other and adapted to grasp a tree or post to be set, and provided with teeth or pins which may be driven into the ground to hold the tree or post in place while the earth is packed around it.

A tooth separator has been patented by Mr. Henry A. Parr, of New York city. The device consists of an angular bar, with an end tapered to a point, and arms curved into semicircular form, making parallel sockets, the arms having screw threads, making a device by the use of which teeth can be readily separated or spread apart to any desired extent.

A pencil sharpener has been patented by Mr. William P. Marston, of Toronto, Ontario, Canada. It consists of a metal plate having a series of transverse bars bent at an angle to the plane of the plate, the edges of the bars forming a series of cutting edges on opposite sides of the plate, the device being more especially designed for sharpening slate pencils.

A clothes drier has been patented by Mr. Joseph V. Fleck, of Lebanon, Mo. Combined with a hollow supporting stand is a vertically adjustable rod, in connection with which are arms so arranged that they will be free to turn about their central supports, and the parts may be adjusted to any position desired, without liability to wabble.

A drag saw has been patented by Mr. Jered P. Cyphers, of Holton, Mich. Its construction is such that the saw may be driven and the various adjustments brought about by a single operator, the desired elevation and a proper and uniform motion given to the saw, the log being advanced the requisite distance with each cut.

A castrating instrument has been patented by Mr. James Trullinger, of Silverton, Oregon. It consists of a serrated cutting blade arranged to coact with a serrated jaw, the blade carrying a block or jaw corrugated to fit the corrugations of the main jaw, and a knife of novel construction being pivotally connected to the serrated cutting blade.

A bell alarm for elevator cars has been patented by Mr. John W. Metz, of Manchester, O. Its construction is such that the person running the elevator is automatically notified every time the floor of the building is reached, and persons desiring to ride up and down are also notified that the car is just arriving at or departing from the floor.

A hoisting machine has been patented by Mr. Friedrich H. A. Peters, of Detroit, Mich. The invention consists of two sets of pawls engaging teeth on the main hoisting drum, with devices for operating the pawls, and a brake attachment, the construction being novel in many details, and the machine durable and effective in operation.

A fireproof attachment for wooden beam ceilings has been patented by Mr. Dennis O'Connor, of New York city. It consists of blocks of baked clay or other suitable material, formed with grooves, flanges, inclines, and shoulders, for convenient attachment, and so made as to cost but little more than ordinary lath and plaster.

A protector for washboards has been patented by Mr. Elbert E. Alderman, of Portville, N. Y. It can be attached to any washboard, and is designed to protect the front of the washwoman's clothes from the spattering water, while by its yielding and reacting movement it permits the body to descend far enough to allow the proper use of the hands in the tub.

An animal trap has been patented by Mr. Richard Matthai, of San Francisco, Cal. It is a simple device to place in the burrows or runways of gophers and other burrowing animals. It has no sharp points or prongs, but spring arms are held open by a disk, which, being struck by the gopher, the arms grasp the body of the animal.

A tether has been patented by Mr. James H. Taylor, of Greenville, S. C. By this invention the rope by which the animal is held is so connected that the animal will be given a free, wide range, but not be in danger of being caught by slack rope, while the arrangement is such that the main strain on the standard is at a point near the ground.

A screw propeller has been patented by Mr. Cotesworth P. Wetherill, of Woodville, Miss. The blades are set inclining in the direction of their length relatively to the axial line of the shaft of the wheel, and forwardly in the direction of the motion ahead produced by the propeller, in a manner intended to give less slip as well as increased thrust.

A button has been patented by Mr. Pierre A. Raymond, of Grenoble, France. It is a novel form of spring button, intended not to differ materially in appearance from an ordinary button, but more especially designed for use as a glove fastener, in which case the separate parts are applied on opposite lapels of the glove, when the buttoning is effected by pressing the parts together in position.

A swinging countershaft frame and belt tightener has been patented by Mr. Gustav H. W. Simmon, of St. Louis, Mo. Its construction is such that by moving a weight away from or toward a pivotal support of a lever the desired strain or tension is brought upon the belt, according to the requirements of the work, the device avoiding the necessity of loose pulleys and belt shifters.

A dry ore amalgamator and separator has been patented by Mr. Otto Matzke, of Gunnison, Col. Its operation is such as to give a jerky reciprocating motion to the amalgamating trough, whereby the crushed ore is carried successively over the mercury contained in several compartments, the construction and arrangement of parts differing from previous machines for similar purposes.

A washing machine has been patented by Mr. George Mowry, of Derby Station, Pa. This invention relates to machines in which a rocking rubber is used, having a semicircular bottom on which are semi-circular transverse strips or ribs, so that the clothes are not thrown about and beaten, but are rubbed between the ribs or strips on the bottom of the tub and the rubber.

A portable roof has been patented by Mr. Clark McE. Keeler, of Haskins, O. It consists of a vertical post with feet and braces, and a roof formed of separable timbers and boards, arranged to slide up and down on the posts, with means for raising and lowering the roof and holding it at the desired elevation, being designed for temporary uses by farmers and outdoor workmen.

A weather strip for windows, etc., has been patented by Mr. George W. Everett, of New York city. It consists of a flexible strip of rubber or similar material, to project from one part of the joint to be closed, and entering at its projecting end within a flute or recess in the other part of the joint, the parts being the parting strips and sashes of the window and meeting rails of the sashes.

A broom has been patented by Mr. William A. Nixon, of Maple Rapids, Mich. This invention covers a pair of metallic frames, secured to opposite sides of the broom, with a socket for receiving a knuckle on the broom handle, which receives a spring acted catch carried by one of the brush holding frames, the handle being calculated to facilitate frequent renewal of the brush of the broom.

A fiber machine has been patented by Mr. James Kennedy, of Kingston, Jamaica, W. I. This invention consists partly in making the scraping block in such manner that the feeding may take place from the side of the machine, and permit the stalks, leaves, etc., to be drawn outward, thereby making a positive feed, the scraper block being supported by springs arranged to prevent recoil and vibrating action.

A baling press has been patented by Mr. George Ertel, of Quincy, Ill. It is for baling hay, straw, and other material, and is so constructed that it may be fed either at the top or at one side, and may be operated when fed from the top without closing the top feed door, or arranged so that either of the top or side doors may be opened automatically by the movement of the plunger.

A bench stop has been patented by Mr. George B. Gardner of Lynn, Mass. It consists of a main plate, with grips, dogs, and other novel features by which work may be held either at the top or side of the bench, whereby two men may use the same side of the bench, on different work, making a readily portable and convenient appliance for carpenters and other woodworkers.

A winding stop for main springs has been patented by Mr. Charles Morlet, of Jersey City, N. J. It is a check mechanism to prevent overwinding and breaking of watch mainsprings, and has a winding wheel revolving with the arbor, and a toothed wheel revolving with such wheel on the arbor, with a pin on the barrel adapted to engage the teeth of the toothed wheel, and several other novel features.

A wire stretcher has been patented by Mr. William N. Huling, of Lampasas, Texas. It consists of a stretcher frame composed of side bars and a cross bar, a hinged loop on one end of the side pieces and a rotary shaft at the other, with ratchet, pawl, and rope, for stretching wires from post to post or for mending broken wires, making a stretcher which costs but little and is not liable to get out of order.

A fire and burglar alarm has been patented by Messrs. Leander E. Thomas and Ira Wood, of Shell Lake, Wis. It has a clockwork alarm mechanism, with a lever rigidly fixed to an escapement lever, and a cord formed with a loop which is passed through an eye and carries a weight, making a device which can be set in any part of a building, and will work automatically.

Drawers designed to act as a support for the spine form the subject of a patent issued to Mr. William R. Standen, of New York city. The invention consists of a waistband wherein the lining and main sections of the band are cut so that when adjusted the band will conform to the general contour of the body, the back of the band being permanently closed, and the adjustment as to size being made from the front.

Parquet flooring forms the subject of a patent issued to Emile F. Guerin, of Paris, France. The boards or strips for the flooring have grooves in their ends which serve to receive metal tongues that are secured to the side edges of the beams, thus making a flooring in which no nail or screw heads will be visible, and in which the boards can contract and expand without warping or throwing.

A vehicle spring coupling has been patented by Mr. Frederick W. Wurster, of Brooklyn, N. Y. Combined with a clip plate having countersinks to receive the closed ends of U-bolts or clips, are yokes uniting the arms of the clips below the spring, and clamping nuts on the clip arms, to facilitate the attachment of the spring and improve the construction of the coupling.

A yellow coloring matter has been patented by Mr. Fritz Bender, of Muhlheim, Hesse, Germany. It is a brown powder which dissolves easily in cold water, the solution being colored red by ammonia or soda lye and precipitated by hydrochloric acid, being soluble in concentrated sulphuric acid with a brilliant violet color, and to be fixed on cotton without any mordant with a bright yellow shade.

A mop holder has been patented by Mr. George W. Fuller, of Westmoreland, N. Y. It has an eccentric spring lever for opening and closing the bail away from and toward the crosshead of the holder, and for securing the bail subject to tension, the lever being made of stout spring wire freely coiled around side trunnions on the handle, in a form that admits of solid and strong construction.

A pump has been patented by Messrs. Adam R. Brown and William H. Bell, of Simpsonville, Ky. Its construction is such that the valves will be submerged while the piston and pump cylinder will be located at the top of the well or cistern, and also provides for the balancing of the column of water in the discharge pipe of the pump, so as to reduce the labor of pumping.

A saddle fastening has been patented by Mr. Winfield S. Lapham, of Clemmons, Col. The invention consists of a novel description of buckle and saddle strap and girth connections, for holding riding or pack saddles to animals, the device being simple and inexpensive, allowing the saddle to be fastened and unfastened quickly, and to be tightened when necessary without requiring the rider to leave the saddle.

A sandpapering and polishing machine has been patented by Mr. Thomas B. Marshall, of Sidney, Ohio The invention covers a wheel upon the face of which are springs covered with felting and sacking, above which is a band of sand paper or a sand band, the sacking and band being secured to the face of the wheel, making a device whereby a flat, oval, and concave surface may be sandpapered and polished with the grain of the wood.

An electric water level indicator has been patented by Mr. Charles H. Wickersham, of Pottstown, Pa. It is for use with steam boilers, to show the

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rise and fall of water in inches and fractions of an inch, and provides for an annunciator for indicating at a distant point the variations in water level beyond the prescribed limits, and also to indicate in which one of several boilers the water is too high or too low.

A hair crimper has been patented by Dina and Rudolph Jordan, of New York city. It consists of two shanks pivoted at one end and connected by a spring clasp at the opposite end, the face of one shank having a groove and the face of the other fitting in the groove, making a device by which the air may be conveniently held in the crimper as long as desirable to form a perfect curl.

A bolt has been patented by Mr. Henry A. Brown, of Toledo, O. It is a round bolt threaded at one end to receive a nut, and having an oblong countersink head, to be received in a countersink or recess of similar form in the tire or other metal work where the bolt is to be used, thus preventing the bolt from revolving while the nut is turned on or off, and avoiding the weakening of the metal by making a round countersink.

A headstall for stock has been patented by Mr. Francis M. Medling, of Rutherford Depot, Tenn. It is so made as to carry a spring with points that rest upon the nose of the animal in a way that will not interfere with its ability to graze or drink, but, on attempting to push off the top rail of a fence, or to suck, the points will prick the nose and deter the animal from accomplishing its object.

A stethoscope has been patented by Mr. Louis D. Radzinsky, of McKeesport, Pa. Its cup is made of soft rubber, in order to be practically a non-conductor of external sounds, and it has a peculiarly constructed tambourine, or drum, whereby the sounds from different regions of the chest or other parts of the body are intensified, the earmuffs being also of soft rubber, with an ear canicula of hard rubber or similar material.

An incubator has been patented by Mr. Frank Rosebrook, of Elmira, N. Y. Combined with the boiler is a hot water tank divided by partitions into channels that conduct the water first to the outside of the tank, then back to the center, a system of pipes connecting the hot water tank and the boiler, and water pans resting upon the pipes, making an improved arrangement for the uniform distribution of heat necessary for hatching.

A gas heating attachment for reversible sad irons has been patented by Mr. Henry C. Fox, of Evansville, Ind. This invention provides a burner calculated to give a flame of great intensity without any increased consumption of gas, and for a more perfect general distribution of the flame over the interior surface of the several sides to be heated, the device being also applicable to cylinders or other hollow bodies requiring to be heated on their interior.

A ditching machine has been patented by Mr. John C. Sage, of Gainesville, Ga. It is mounted on a car, with a vertically adjustable crosspiece carrying plows, with movable carriages and conveyer frames hinged therein, with means for adjusting their lower ends vertically, and flanged conveyer belts and means for rotating them, the machine being calculated for digging ditches, excavating the foundations of houses, and similar work.

A harness hook has been patented by Mr. John H. O'Donnell, of Winnipeg, Manitoba, Canada. It is intended especially for use as a check rein hook, the base, by which the hook is secured to the saddle, having at its forward end a lateral notch to receive the free end of a latch hook or open link pivoted to turn in a plane at right angles to that of the hook proper, so the rein cannot be released until the link is adjusted to open position.

A straw-board lining machine has been patented by Mr. Arnold W. Schlichte, of New York city. The mechanism is such that the operator is able to sever the web which constitutes the lining material between each sheet of board after the material has been pasted and pressed to place upon the board, the parts being so arranged that sheets of board of varying size may be used without changing the adjustment of the machine.

A burglar-proof safe has been patented by Messrs. John W. Norris, of Chicago, Ill., and Thomas M. Brintnall, of Maryville, Mo. The invention consists essentially in interlocking the bolt ribs with the safe door by dovetail joints, providing a construction to connect the bolt-carrying devices without the introduction of screws or threaded bolts, and making a firmer and stronger connection between the doors and the bolt-carrying devices.

A watch has been patented by Mr. Domingo T. Garcia, of Guadalajara, Mexico. It has two crown wheels mounted on an arbor in the case, one of the wheels having more teeth than the other, a pinion engaging the teeth of both crown wheels, with a crown scape wheel on its shaft, with other novel features, making a watch with very few parts and designed to be very accurate.

A clock has likewise been patented by the same inventor, whose construction is based upon the principle of differential gearing. It has but few parts, two toothed wheels being mounted on the same shaft, one fixed and the other loose, an escapement anchor pallet engaging with both wheels, the loose escapement wheel having part of its face cut out and a circular scale formed around the opening, with other novel features, the use of the usual multiplying train being dispensed with.

A parasol for children's carriages has been patented by Mr. John McAuliffe, of Jersey City, N. J. A notched runner is held on a clamp attachable on the stationary rod fastened to the carriage, a stick with a notched collar supporting the braces, a cord from the upper end of the stick passing through the runner, and a spring on the stick engaging with a slot in the runner, so the parasol can be supported in an angular position, and opened and closed from the top or outside.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Books** referred to promptly supplied on receipt of price.

**Minerals** sent for examination should be distinctly marked or labeled.

(1) W. T. T. says: Please oblige an old subscriber with the receipt to prevent awnings and cotton goods from mildewing. Also a receipt to make tents waterproof. A. 1. Use 4 oz. powdered alum and 4½ oz. sugar of lead, dissolved in 3 gals. water. When perfect subsidence has taken place, pour off the clear liquid only, and add to it 2 dr. isinglass, previously dissolved in warm water, taking care to mix thoroughly. Steep the goods well, and dry without wringing. 2. In 80 parts of water heated to about 80° C. melt 3 parts of gelatine and 6 of castor oil soap; then add 3 parts gum lac, stirring the liquid until entirely dissolved. Withdraw from the fire, and add to the mixture, little by little, 6 parts of powdered alum, stirring all the while. The liquid thickens in forming an insoluble alum soap, which is intimately incorporated with the gelatine and the gum lac. Spread it over the stuff with a bristle brush.

(2) F. P. M. asks how many "crow-foot" gravity cells 5 inches by 6 inches it will require to run a 16 candle power incandescent lamp, and how they are to be connected. A. Assuming the cells to give one volt each, and to be of 2·00 ohms resistance, 512 such cells arranged in eight parallel series of 64 each would supply a 16 candle power lamp.

(3) E. C. E. asks: 1. Can you give me a good recipe for liquid stove polish, such as stove builders use? A. Take of pulverized black lead 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce. 2. A recipe for a glossy and quick drying furniture polish not having much color. A. Dissolve 4 ounces best shellac in 2 pints of 95 per cent alcohol; add to this 2 pints of linseed oil and 1 pint of spirits of turpentine; when mixed, add 4 ounces of sulphuric ether and 4 ounces ammonia water; mix thoroughly, shake when used, and apply with a sponge lightly. 3. A safe and quick liquid for cleaning silverware? A. The best thing to use is two teaspoonfuls of ammonia, dissolved in a quart of hot soap suds. 4. A solvent for cellulose. A. Cellulose dissolves completely in an ammoniacal solution of oxide of copper.


### TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.


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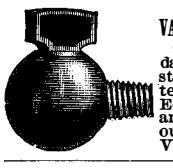

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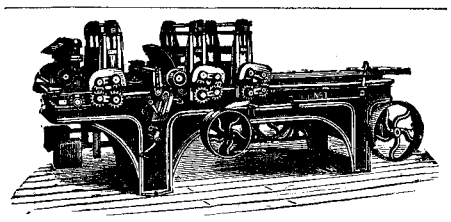

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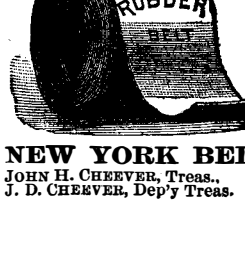


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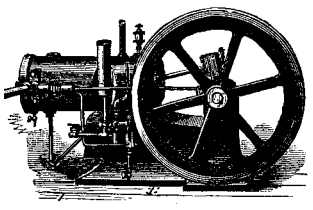

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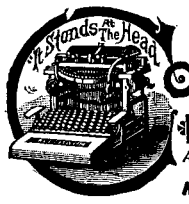


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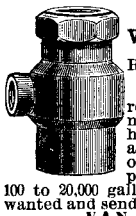

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| 6-inch | ..... | 3¼ tons. |
| 8 " | ..... | 5 " |
| 10 " | ..... | 9½ " |
| 10½ " | ..... | 9¾ " |
| 12 " | ..... | 12½ " |

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4¼ feet by 6 inches thick.
There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.
*First.* Gun Forgings.
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And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
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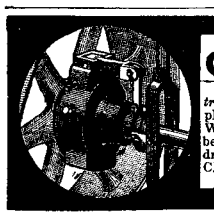

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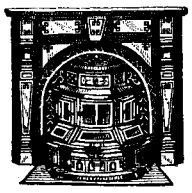

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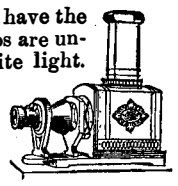

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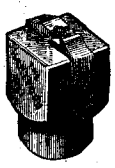

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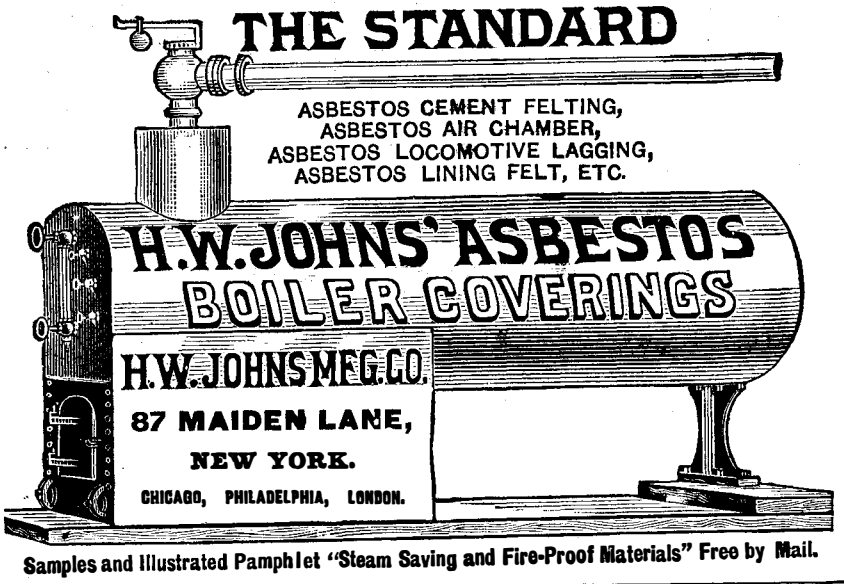


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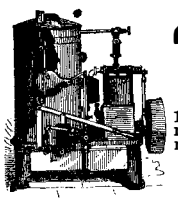

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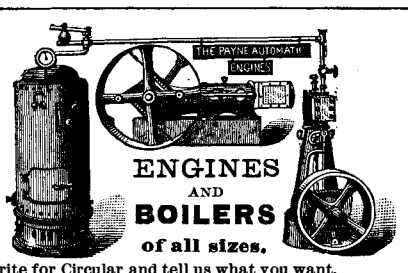


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